PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,

167-177 TIMES BUILDING, NEW YORK.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 28 Hathaway Building, Boston.
Western Office, 465 The Rookery, Chicago.
Philadelphia Office, 927 Chestnut Street.

SUBSCRIPTION, IN ADVANCE, ONE YEAR $3.

(Including Postage in the U. S., Canada or Mexico.)

In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED 17 YEARS AGO, THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the LARGEST CIRCULATION of any electrical periodical in the world, and is the BEST ADVERTISING MEDIUM.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned unless accompanied by the necessary postage when received.

Situation or Help Wanted advertisements $1 to $2 an insertion according to length.

Address all communications to

THE W. J. JOHNSTON COMPANY, Ltd.,

Times Building, New York,

OR ANY OF THE BRANCH OFFICES.

VOL. XVIII. NEW YORK, DEC. 5, 1891. NO. 23.

CONTENTS.

EDITORIAL: PAGES.
Paragraphs 411

ILLUSTRATED ARTICLES:
A Novel Temporary Lighting Plant 413
Electricity in Mining.—II 414
Electric Fixtures for Exterior Illumination 416
A Group of Static Motors 418
Test of the New Thomson-Houston Electric Locomotive 419
Illuminated Campaign Banner 421
New Security Insulator 421
The Gill Water Tube Boiler 421
The Sintz Gas Engine 421
The New "C. S." Portable Lamp Stand 422
An Automatic Electric Valve for Steam Heating Systems 422
Electrix China Switch 422
An Adjustable Electric Light Switch 422

MISCELLANEOUS:
Latest Foreign Electrical News 412
Search Lights on the Upper Mississippi, by Horace M. M'Cord. 412
The Havana Electric Light Station 412
Elements of Practical Electricity, by Dr. Louis Bell 412
Electric Railways in the South 413
Dinner of the Magnetic Club 415
History of Electricity, by P. F. Mottelay 417
Formation of the Canadian Electrical Association 418
Practical Applications of Electricity in Coal Mining, by E. B. Richart 419
The Accumulator in Commercial Work, by J. Stanford Brown 420

FINANCIAL INTELLIGENCE: The Electrical Stock Market, 423; New Incorporations, 423.

SPECIAL CORRESPONDENCE: New York Notes, 423; New England Notes, 423; Western Notes, 423; Southern Notes, 423; Canadian Notes, 424; English Notes, 424.

NEWS OF THE WEEK: The Telegraph, 425; The Electric Light, 425; The Electric Railway, 425; Legal Notes, 425; Educational Notes, 425; Personals, 425; Miscellaneous Notes, 425.

INDUSTRIAL AND TRADE NOTES 425

BUSINESS NOTICES 426

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS 426

For One Night Only.

THE remarkable electric light installation that we describe this week is quite unique in electrical history. A thousand-light plant set up in a barnyard for the use of a single evening is certainly an example of the American way of doing things that may not bear frequent repetition, but is none the less interesting. So far as the appearance of the generating plant goes it is apparently the ultimatum of crudeness, with the possible exception of a new plant vaguely located out West in a very new town where the dynamos were for some months operated without any covering at all saving a tarpaulin stretched over them on poles when it rained. Nevertheless for the short time of service required of it the temporary apparatus for Mrs. Twombley's ball did excellent work and ran apparently as well as the most permanent of its compeers. The barnyard plant and the electric jack o' lanterns will be long remembered by those who saw them, and furnish a beautiful example of what can be done if need be by invoking the aid of electricity and its votaries.

Dreams and Realities.

OUR cable dispatch this week contains several bits of news that we would respectfully commend to the attention of the commission that is looking, rather too deliberately, after the interests of the metropolitan public. While we have been meditating on the remote possibility of an underground road, our English cousins have completed one, are preparing to extend it, have begun preliminary borings for a second, and have plans drawn up for still others. There are two ways of accomplishing a given engineering work—thinking industriously of how it may be done, waiting continually meanwhile for a few more possibilities to unfold themselves, and on the other hand pushing ahead and accomplishing something. If New York waits for the end of improvement in rapid transit methods, it will have an adequate system about the year of grace $(n+1)$. Given the immediate necessity, and something practical can be evolved; given indefinite time for meditation, and the result will be well-nigh eternal procrastination.

Exterior Electric Fixtures.

WE publish this week the first portion of an article on exterior fixtures. This is a branch of illuminative art of comparatively recent development so far as electricity is concerned. Electric lamp posts there were and electric lanterns over doorways, but the evolution from these to fixtures of the most beautiful and artistic design has been the work of the past few years only. After seeing some of these exquisite specimens of bronze and iron work one revolts against the unmitigated ugliness of the average lamp post, and instinctively wonders if the time will ever come when the City Fathers will look beyond pure utilitarianism in lighting the streets. We have as yet only begun to appreciate what may be done in the way of electrical illumination. A few of the recent experiments have indeed given a glimpse of the possibilities in the case, but as yet most electric lighting is somewhat crude and inartistic. Reports from the Frankfort Exhibition seem to indicate that our continental friends can give us a good many suggestions in this particular line of work, but for all that we feel confident that it will be a long time before they surpass some of the electroliers we are illustrating.

An Electric Locomotive.

THE recent trial at the Thomson-Houston works of a 125-h. p. electric locomotive for freight transport is an event well worth special mention. The shunting of cars by electric motors is not altogether a novelty and their transfer over short lines from one railroad to another has been in regular practice in at least one place, but deliberately to build a locomotive for the purpose of doing ordinary service in shifting freight cars from the factory to a main track, two miles distant, is an extension of motor work worth remembering, more for its bearing on the future perhaps, than for its immediate result, however interesting it may be. It is the first real inroad made in this country on the province of the locomotive, and we may well expect that it will be followed by many another until long lines are in operation by high speed electric engines. The result of this experiment will be watched with interest, and there is no reason to expect anything but complete success, for there are no very unusual conditions to be met, no particularly severe service to be done compared with what is encountered every day on street car lines. It may, however, be regarded as the beginning of electric traction on a larger scale than anything heretofore attempted.

Killed by the Trolley.

THE latest trolley wire sensation hails from Pittsburgh, and furnishes a beautiful illustration of the singularly true remark made not long since that to those working around electric wires gravity is far more dangerous than the current. A steam fitter at work in a railway power station undertook to drive a nail and struck a trolley wire, the shock threw him from the ladder upon which he was perched, and the fall produced a fracture at the base of the skull, from which he soon died. To this statement of facts the reporter with the agile imagination blandly added, "it is supposed, however, that he was dead before he reached the ground." This addition to the tale may be picturesque, but the supposition was entirely gratuitous. Such yarns as this can do no possible good, and their motive is almost inconceivable. Some of them doubtless arise from dense ignorance, but one would suppose that by this time, after the investigation of story after story of this character, the public would have become educated up to the point of understanding that no man has yet been killed by a shock from a trolley wire. Instead of inveighing against overhead wires, it would have been more appropriate for the scribe in this particular instance to have denounced in severest terms the law of gravitation, and demanded its immediate repeal.

Static Motors.

ELSEWHERE in our columns will be found a brief account of an ingenious group of motors to be operated by static electricity that has been recently devised by a clever amateur in this city. Of course no one seriously proposes to utilize such machines except for purposes of instruction, but in this province they are undoubtedly valuable. The final form of a cylinder with sheet brass armatures revolving on a horizontal axis bears considerable resemblance to some of the very early types of electric motor and its performance shows that it is capable of giving a perceptible amount of power, and, with some modifications, considerably more than at present. In this machine the rotation is produced by attraction between a charge on a fixed pole piece and a charge of opposite sign on the moving armature, a commutator being provided to give the proper segment its suitable charge at the right moment. All this is very like an electric motor with fixed electromagnets attracting movable ones. By taking a hint from such motors one might by connecting poles in parallel very easily double the attractive force by utilizing the attraction of four armatures instead of two; indeed, with a larger revolving cylinder six or eight poles might be used and a correspondingly greater torque obtained. Such machines are valuable as illustrating the striking similarities between electrical and magnetic attraction, as well as pointing out the characteristic differences, and they should find their way to the lecture table of many a professor in our schools and colleges. Electrical education is not all it should be in most institutions, and every bit of apparatus that can be brought into play to illustrate the general principles simply and clearly is of undoubted service.

High Speed Electric Traction.

APROPOS of the remarks we have just made on the new electric locomotive for freight service, is it not about time for some one to take hold in earnest of the task of accomplishing the two-mile-a-minute-express feat that has been so often discussed? One such project is on foot now in a somewhat vague and indefinite way for a road between Milwaukee and Chicago in the year of the great exposition. Our continental friends, too, are threatening not only to build such a line from Vienna to Budapest but to show their prowess on American soil, if they receive sufficient encouragement, in 1893. With all this talk it is time something was done. As the matter stands to-day the question of the necessary funds is the only serious one. The high speed runs that have been recently indulged in over several of the American railroads show well enough that a track capable of standing very high speeds can be laid down without unreasonable expense. They also show that the steam locomotive has not reached its ultimate speed, although the severe output required of it is anything but economical. There are plenty of electrical engineers who would undertake the task of designing the necessary power equipment, and who would complete it successfully. Any one of the large companies has both talent and manufacturing facilities at its disposal to carry the work to its completion. With all this it seems that the only thing that stands in the way of 100 or 125 miles an hour is the one difficulty of securing capital. This ought not, considering the adventurous spirit of American financiers, to be a task of forbidding magnitude if it were once seriously undertaken. Who will be the first to make the move and give to the world facilities for intercommunication vastly superior to anything that has yet been known?

Is Electricity a Manufactured Article?

AT first sight this may seem a grotesque question, but it has a very serious financial aspect and in fact more than one law suit to determine this point is at present in progress, one, indeed, in New York City. The point at issue is the taxation of central stations, for many States and cities make a wide difference between manufacturing establishments and others. If electricity is a manufactured article then it should be treated with the same consideration due to the establishment of a new industry, with as much gentleness as if it were a soap factory or shoe shop. Then, too, the question is likely to arise from time to time whether the electric current is dutiable. It is one of the few things that the redoubtable McKinley did not specifically include in his amiable tariff bill, but it might be levied upon as an unclassed manufactured or unmanufactured article for the benefit of the governmental pocket. A question of opinion such as that involved in this inquiry is one to fill the hearts of our legal friends with unwonted joy, for there are as many sides to the subject as there are human beings to discuss it. Does a change in the form of energy constitute manufacture? Is the electric current a substance or not, and in either case is it in any sense properly manufactured in the central station? If it is a substance, has it been altered in form sufficiently to be classified as a manufacture? If it is not, can it be manufactured at all? These are a few of the pleasant questions that arise for solution before the courts, and the longer one discusses them the more hopelessly abstruse do they seem to be. As a matter of plain straightforward equity, an electric light station and gas works ought apparently to stand on precisely the same footing, but whether under our existing laws this can be permitted is another question. For example, is an establishment for the distribution and sale of power, whether transmitted by cable, steam or compressed air, a manufactory? If it is not, should the distribution of power by electricity be classified as manufacturing? On the other hand, is not the production by the consumption of coal of an available something for human advantage manufacture, whether it is a current of gas or of electricity? It is one of the cases where appeal cannot be taken to logic, for logic is left out in the cold in such a varying series of analogies; nor can one appeal to ethics, for ethics is not always considered in adjudicating disputes; so after all it may have to be settled on a purely legal basis. If so, no man can tell what the result will be, for the laws are not universally bound by any code of either ethics or logic.

Latest Foreign Electrical News.

(By Cable from Our Own Correspondent.)

LONDON, Nov. 30, 1891.—On last Wednesday an advisory meeting for the furtherance of the coming electrical exhibition at the Crystal Palace, London, was held at the Mansion House, the Lord Mayor of London presiding. After transacting other business a committee of experts was appointed to undertake tests of apparatus in connection with the exhibition.

Another attempt is to be made to secure a northern extension of the City & South London Railway; it will be remembered that last year a similar effort was made but was refused by the House of Lords.

Work is beginning on the Central London Railway that was authorized some months since by experimental borings along the line to determine the character of the underlying earth through which the tunnel must be driven.

Still another electric subway on the general plan of the City & South London line is proposed to run from Finsbury Park to the city. No formal action, however, has yet been taken.

The National and the new telephone companies are applying for statutory powers to run overhead and underground wires, and if granted telephone competition will soon become active.

On Friday last a number of prominent citizens of Glasgow paid a well deserved compliment to Sir William Thomson by presenting his portrait to the Glasgow University which he has so long served with distinguished honor.

Search Lights on the Upper Mississippi.

BY HORACE M. M'CORD.

In THE ELECTRICAL WORLD of Nov. 14 there is an article on "Optical Science in its Relation to Electric Lighting," in which it is stated that the use of the electric search light on the Mississippi River steamboats had decreased to a small percentage of what it had been, owing to the brilliant flaring of the light. The writer of the article in question, Mr. C. B. Boyle, must be quite ignorant of steamboating on the Mississippi, for as a matter of fact there is scarcely a steamboat engaged in the lumber or any other trade above St. Louis, Mo., which is not equipped with that "flaring" search light.

In rafting, a lamp throwing parallel beams of light would be useless except for revealing objects on the bank, while a flaring light will illuminate the whole raft, which may be 900 feet long and about 300 feet wide. It will also show an object ahead of the raft or on the bank very distinctly. There are very few "stretches of ten miles" on the "upper river," and pilots are careful not to flash the light in another's face.

All pilots unite in declaring that rafting on the upper Mississippi after dark would be an impossibility if they were not able to see at a glance any part of the raft, which it would be impossible to do with a parallel beam light and still have the light shine ahead. In running bridges, a pilot must be able to overlook the entire raft and still keep his light on his "points" ahead of him.

The Havana Electric Light Station.

The Havana electric light station, one of the best equipped electric light stations in Spanish America, has recently been completed. It is situated within the premises of the United Gas Companies of Havana, and was started with a small plant, consisting of a Westinghouse 1,500-light incandescent alternating current dynamo, and two 50-light arc machines, early in the year 1889, merely as an experimental plant and also to provide electric lights for those few people who desired that form of illumination in place of gas. The demand for the new light, however, increased so rapidly that the directors of the company, after obtaining from the municipal authorities an assurance that they would agree to have certain public places and streets lighted with electricity for as long a time as the lights continued to give satisfaction, determined to equip a station that would be ample for the prospective demand. A building 195 feet long by 90 feet wide, of brick, with an iron roof, one story high, has been erected, and in this structure have been placed 10 engines, two Westinghouse compound condensing, and eight Armington & Sims horizontal high speed, the collective motive power of which is 1,125 h. p.

Steam to supply these machines is obtained from seven boilers of a capacity of 150 h. p. each. The generating plant consists of four Westinghouse 1,500-light alternating current and eight 50-light arc dynamos, with the addition of one other incandescent and two arc dynamos, the entire capacity of the station being 8,250 incandescent lights and 500 arc lights. The incandescent switchboard is of massive The board is supplied with the latest appliances, including construction, being built of very heavy cedar lumber. current registering voltmeters, lightning arresters and testing instruments. The arrangement of the changing devices is very convenient, the attendant being able to change the load from one dynamo to another, or to make any combination of the eight dynamos and the circuits leading from these, without altering his position. The arc switchboard is arranged for 12 circuits. The interior of the station is floored with cement. The station is also equipped with an efficient service of pumps, for feeding boilers, condensing and fire purposes, also with feed water heaters and separators.

The promotion of this enterprise and the successful shipping of the large amount of machinery required is due to the executive ability displayed by Mr. R. A. C. Smith, of New York, vice-president and treasurer of the Spanish American Light and Power Company, and also Mr. Ricardo Nargenas, general manager of the company in Cuba, who superintended the construction and completion of the station. Mr. F. H. Thompson is the electrician for the company in Havana.

Elements of Practical Electricity.*

BY DR. LOUIS BELL.

Having carefully set up your galvanometer, connect its binding posts to the terminals of one of your Daniell battery cells and very carefully note the deflection produced in the needle. If the latter has been properly adjusted, its two ends will make exactly the same deflection, as nearly as the eye can read; then reverse the connections of the battery with the binding posts and note the deflections again; they should be precisely equal to those last found, but as a rule the correspondence will not be exact, and the deflections read from the two ends of the needle and with the current in two directions will vary even as much as one degree. This is an inconvenience, but does not prevent doing accurate work, as in such a case the average of the four deflections will be correct far within the errors which one will necessarily make in estimating the position of the needle. For example, if the north end of the needle is deflected 35 degrees and the south end 34 degrees with the current in one direction, and on reversing the current the north end is turned 35 degrees and the south end 36 degrees, which case would represent worse adjustment than usual, the correct deflection would be 35 degrees, the average of the four readings, and would be exact within a very small amount. Having obtained the reading for one of your Daniell cells, try the other; as a rule you will find that it will give a slightly different current, owing mainly to a different internal resistance in the cells.

One, for example, may have a slightly more concentrated acid or copper solution than the other or a porous cup of greater or less resistance. Now try one of your bichromate cells and you will see at once that you have obtained a powerful deflection indicating a current much greater than anything which a Daniell cell could give, probably three or four times as great. As the tangent of angles increases so rapidly as the deflection increases, the actual difference in position of the needle may not be very great but the difference in current will be. Try then the other bichromate cell. You will find that it varies from its mate in strength, but that both are notably more powerful than either of the Daniell cells.

ESTIMATING FRACTIONS OF DEGREES.

The current given by each of the batteries will be exactly proportional to the tangent of the angle of deflection, but in comparing two cells of the same kind this may amount to only a degree or two, possibly only a fraction of a degree. It is well, therefore, to understand something about estimating these fractions.

Probably the easiest plan for you at present is to estimate only halves and quarters of degrees; if the needle stands midway between two degree marks when you so hold your eye that the needle is exactly over its reflection you will readily be able to recognize the half degree; if the point, however, should not be exactly half way between two degrees. you may be a little puzzled. Your best way is to record the deflection as the nearest quarter degree; if the pointer is nearer the half way point than either of the degree points, call the deflection a half degree; if nearer the degree marks than the centre, count it for a quarter.

A little practice will enable you to estimate more exactly even than quarters of degrees. It is customary among electricians to estimate tenths of degrees, and you will be surprised to find with what accuracy you can do this after a little practice. You do not at all need a galvanometer, or, indeed, an arc of any kind, in order to get familiar with the process of estimating tenths; any rule divided as closely as thirty-secondths of an inch will serve your purpose. Taking such a one, mark on a piece of paper pairs of dots five-sixteenths of an inch apart, then take a pencil point and try to place it at four-tenths of the distance between the pair of dots, in other words to mark a point just a little less than half way between them.

After marking a four-tenth point measure its exact position with your rule; it should, of course, be four thirty-secondths from the nearer dot. If you do not hit it right the first time, try again, then take three-tenths, two-tenths and one-tenth in the same way, after which you will find it very easy to lay off six-tenths, seven-tenths, eight-tenths, and nine-tenths. A half-hour spent in practising this estimation will be very useful to you in reading galvanometers and all similar instruments.

EFFECT OF RESISTANCE ON CURRENT.

You have already seen that interposing a long piece of wire in a battery circuit lessens the effect produced, but you will more readily appreciate this when you have a comparatively delicate instrument like the galvanometer with which to detect the difference. For example, insert in the circuit that contains your galvanometer and one of your Daniell batteries all the wire you have at hand. You will find of course that the current is very much diminished in strength by being obliged to pass through the extra amount of wire.

The exact amount by which it is diminished you can find by comparing the tangents of the two angles of deflection, with and without the wire. Try a piece of the fine iron wire used in one of the early experiments and you will obtain a still more marked effect, and the little incandescent lamp will reduce the current still more. Finally put into circuit, if you have one handy, an ordinary incandescent lamp and you will find that the deflection, produced is hardly pereeptible, showing that the lamp possesses a high power of resisting the passage of the electric current. As a matter of fact the current from your battery cell can flow through half a dozen miles of wire such as you used to wind your galvanometer as readily as through the six-inch filament of the incandescent lamp; a piece of iron telegraph wire, too, you would find to produce nearly as great an effect in checking current as an equal length of your No. 16 copper wire, although the size of the telegraph wire is very much greater.

This, like the experiment with the incandescent lamp, shows that the power of a given material to resist the passage of the electric current depends not only on its size, but the particular character of the substance you are working with. Similarly, making a connection between the battery and galvanometer through a glass of water in which the ends of wire dip; you will find that you have interposed a very high resistance, and the extremities of the wires will have to be brought quite close together in the water before you can get a noticeable deflection of the pointer. In experimenting with iron wire you should keep it as far as possible away from the galvanometer, even if you have to move your battery off a number of feet and lengthen the connecting wires. This is because the magnetic needle of the galvanometer tends to be attracted by the iron in whatever position it happens to be, and for that same reason in setting up the galvanometer it should be assiduously kept away from all masses of iron of whatever kind. Iron, steam, gas and water pipes are especially bad, particularly the first as its magnetic state varies according to its temperature, so that a galvanometer will be differently affected when steam is on or off. It is best to set up the galvanometer permanently in some convenient place where it will not be disturbed, only moving it when necessary. Disturbance from iron pipes is so great that most laboratories or portions of buildings where delicate measurements are to be made are supplied with heat, gas or water through brass or lead pipes and no iron fixtures are employed.

COMPARISON OF RESISTANCES.

You have already found that interposing a length of wire of any material in the circuit which includes your battery and galvanometer will by virtue of the resistance of that wire so diminish the current flowing as to produce quite a marked effect on the galvanometer deflection. A little consideration will show you that if two pieces of wire produce just the same effect in diminishing the deflection, all the other conditions remaining constant, they must have the same resistance to the passage of current, and thus you can compare the two resistances by means of the tangent galvanometer roughly, it is true, but still well enough to prove decidedly instructive.

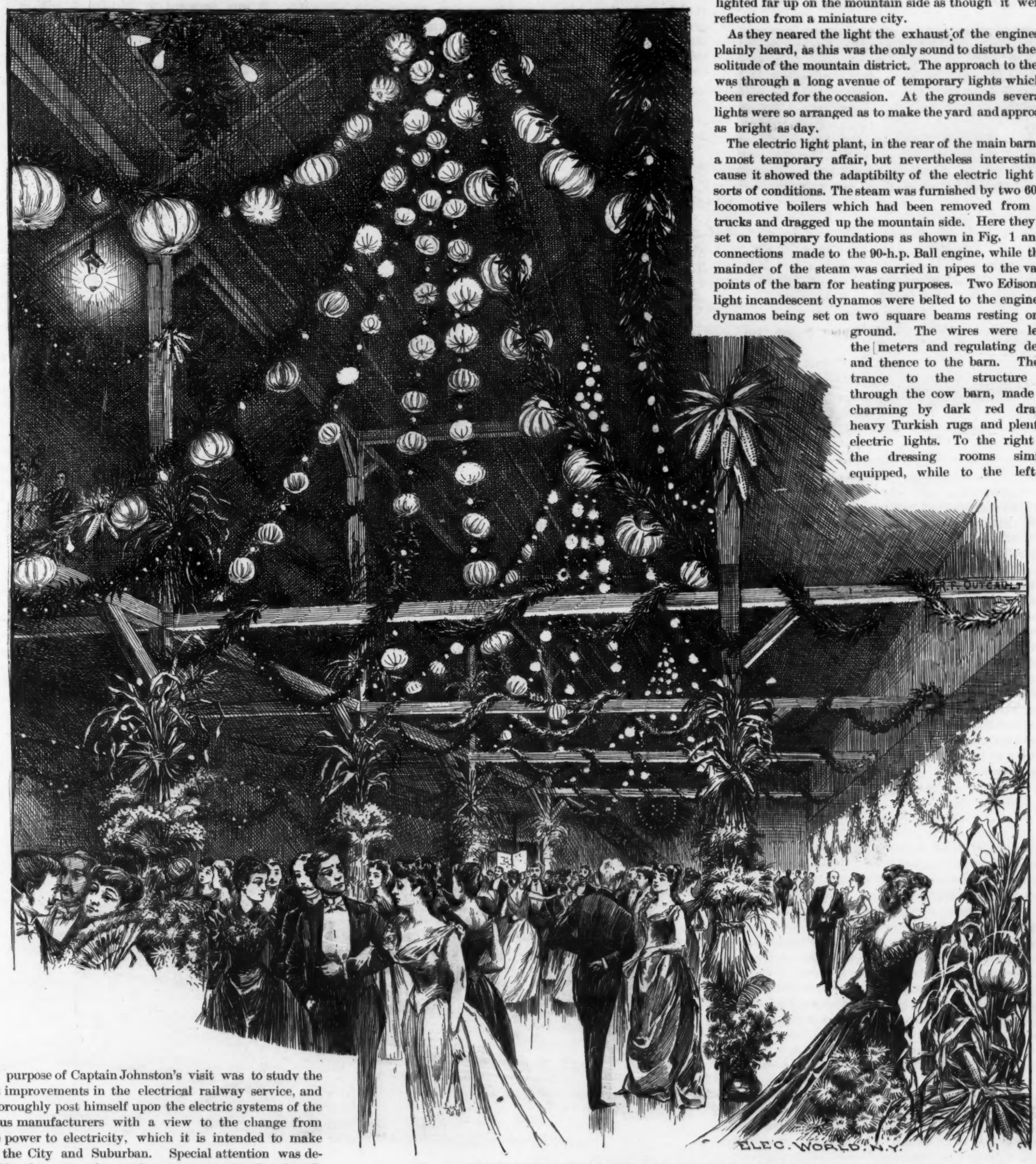
Having put one of your Daniell cells in circuit with the battery by means of the thickest copper wire you have at your disposal, put a little incandescent lamp in circuit, and note the point where the pointer comes to rest, then buickly remove the lamp, and takinga piece of very fine bare iron or copper wire insert it in the circuit and slip one end of it through the binding connected to your battery. On tightening the binding screw a full flow of current will be sent through the wire you are trying, and the galvanometer deflection will be cut down somewhat. Adjust the wire until you get just the same deflection as when the lamp was in circuit, and the resistance of the two will then be equal. Test in the same way any other convenient piece of wire or other conductors which you happen to have at hand.

In adjusting resistances to equality in this way you have assumed that the battery is acting toward one precisely as it would toward the other; in other words, that it is constant. This is very nearly true of the Daniell cell, unless the operation of adjusting resistances is very slowly done or unless the battery is very recently set up. Before trying the experiment it is better to close the battery circuit on the galvanometer and let it work until the deflection becomes steady. As the galvanometer needle is likely to swing for some time before it comes to rest, you can quicken your observations by a little experimental device that is very familiar in laboratories and exceedingly convenient for the purpose. Instead of waiting for the pointer to become perfectly steady, wait until it is swinging steadily through a very small arc, a couple of degrees or so, then note the points corresponding to the extreme limits of the swing and take the midway point as the true deflection; for example, supposing one end of the pointer is swinging between 35½ and 37½ degrees, the true deflection should be taken as 36½ degrees. This little trick hastens the process of making readings immensely and where quickness is necessary or convenient should always be used.

* Continued from THE ELECTRICAL WORLD of Nov. 28, 1891.

Electric Railways in the South.

A recent issue of the *Morning News*, published at Savannah, Ga., had the following interview with Mr. J. H. Johnston, president of the City and Suburban Railroad Company of that city, who recently returned from Pittsburgh, where he attended the convention of the American Street Railway Association. President J. H. Johnston has returned to the city. He expressed himself as pleased with the results of the meeting of the American Street Railway Association, and his visit generally. The chief purpose of Captain Johnston's visit was to study the latest improvements in the electrical railway service, and to thoroughly post himself upon the electric systems of the various manufacturers with a view to the change from horse power to electricity, which it is intended to make upon the City and Suburban. Special attention was devoted by the convention to improvements in electric railways, and the merits of the inventions were fully discussed. Pittsburgh itself proved to be the most complete exposition of the electric railway system, as it is a town of steep hills and sharp curves, and it has nothing but electric railways. In fact it would be almost impossible for horses to pull the cars up the steep hills. Captain Johnston says the discussions before the association brought out several things very plainly. The perfection of the storage battery system, the ideal of the electric railway service, appears as far distant as ever, and the present overhead trolley system will probably continue for years to come. Edison was said to have perfected such a system a short while ago, but his representative at the meeting said that such an accomplishment is still in the dim and distant future, and that he did not anticipate such a result in 15 years at least. Another thing was that the double reduction system, introduced about three years ago, had been superseded by the more simple and more satisfactory single reduction system. This in turn is threatened with being superseded by the gearless motor, which is, as its name implies, simpler still and less likely to get out of order. The gearless motor also has the advantage of being entirely covered by an iron box, which protects the machinery from dust, mud and water. The chief objections to the gearless motor are that it is new and untried, comparatively, and very heavy. The single reduction system, Captain Johnson, says, is the general favorite. The Westinghouse, Thomson-Houston, Short, Edison and other companies are now manufacturing both systems and are confident of their entire perfection in a short while. As an instance of the wonderful advance in the manufacture of electric car motors it may be mentioned that motors that were worth thousands of dollars a few years ago are now valuable only as old junk, having been entirely superseded by later inventions. Captain Johnston said that the City and Suburban will adopt either the gearless or the single reduction system. If the gearless system succeeds the company will adopt that, but if it fails the single reduction system will be adopted. There were a number of inventors and manufacturers before the association with wonderful improvements which they had made very recently.



TEMPORARY ILLUMINATION AT MRS. TWOMBLEY'S BARN PARTY.

A Novel Temporary Lighting Plant.

It is not often that a complete electric lighting plant is erected for a single night's service, nor does it often come to notice where an equipment of this kind is installed on a farm far from the scenes of city life. For this reason the electric light effects at the barn festival and dance given by Mrs. H. McK. Twombley in the new stock barn at Madison, N. J., on the 18th inst. is of more than passing interest.

As the guests left the station and started across the dark Jersey hills they were surprised to see the sky brilliantly lighted far up on the mountain side as though it were the reflection from a miniature city.

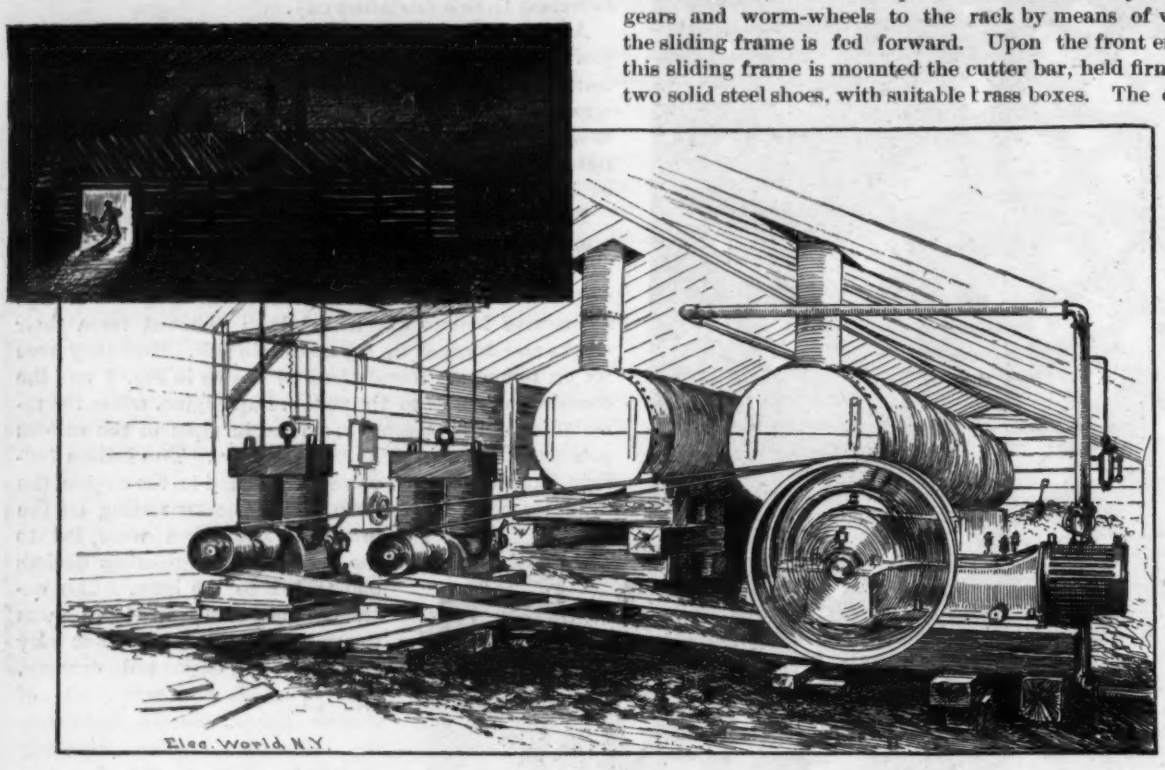
As they neared the light the exhaust of the engines was plainly heard, as this was the only sound to disturb the quiet solitude of the mountain district. The approach to the barn was through a long avenue of temporary lights which had been erected for the occasion. At the grounds several arc lights were so arranged as to make the yard and approaches as bright as day.

The electric light plant, in the rear of the main barn, was a most temporary affair, but nevertheless interesting because it showed the adaptibilty of the electric light to all sorts of conditions. The steam was furnished by two 60-h. p. locomotive boilers which had been removed from their trucks and dragged up the mountain side. Here they were set on temporary foundations as shown in Fig. 1 and the connections made to the 90-h.p. Ball engine, while the remainder of the steam was carried in pipes to the various points of the barn for heating purposes. Two Edison 500-light incandescent dynamos were belted to the engine, the dynamos being set on two square beams resting on the ground. The wires were led to the meters and regulating devices and thence to the barn. The entrance to the structure was through the cow barn, made very charming by dark red drapery, heavy Turkish rugs and plenty of electric lights. To the right were the dressing rooms similarly equipped, while to the left was as pretty a drawing room as could be found in any private residence.

The main hay barn where the dance took place, as some said in describing it, might have been called an "agricultural paradise." The decorations were entirely autumnal. Everywhere specimens of the rich harvest were strewn in profusion, or caught into the most artistic positions by garlands of mountain laurel. The main columns of the centre arch were made twice their size by bunches of wheat, ripened corn, pampas grass, sprinkled here and there with wild mountain berries, the lighting festoons stringing along beams and rafters, peeping in and out of wheat and corn and hidden behind pumpkin shells. The electric light was everywhere, completely filling every nook and corner of the vast structure with a warm beautiful glow.

The barn was 250 by 80 feet, while from the floor to the peak of the roof was a distance of some 60 feet. From four different points along the ridge, swinging in graceful profusion to the first loft, were great streamers of mountain laurel with yellow pumpkins at regular intervals, inside of which were burning 16-c. p. lamps. Between these pumpkins, which in themselves formed a very beautiful lighting effect, were found other incandescent lamps, so that these streamers formed a mass of color and light such as is very rarely attained.

Extending along the arcade on either side were two continuous garlands made fairly afire with miniature incandescent lamps. It was here that the decorative effect of the



TEMPORARY LIGHTING PLANT AT MRS. TWOMBLEY'S BARN PARTY.

electric light showed itself to the best advantage. At either end of the barn were two immense crescents of rhododendrons, out of which peeped the incandescent light, showing off to excellent advantage against the dark green background. The whole effect was exceedingly artistic.

The rich colors of the autumn fruits were warmed into their natural tints by the rays of the electric light, giving the effect of plenty, comfort and hospitality. The dining room and other rooms off the main structure were equally beautiful.

Although the dance lasted until early in the morning, there was no interruption of the lights from any cause. The lamps burned up to full candle-power and no accident of any kind occurred. Leaving this brilliantly lighted barn and going out into the cold night air, one could not resist the conclusion that to the electric light was due the credit of turning a rude barn into a veritable palace and making this occasion a memorable one.

The Variation of the Electromotive Forces of Batteries under Pressure.

In a note contributed to *Comptes Rendus* M. Henri Gibault states that the variation in electromotive force of batteries under pressure in cases where no gas is disengaged may be expressed by a formula of the form

$$E_o - E = a\,p - b\,p^2,$$

b being a very small quantity in cases where the pressures are not very great, the variation in fact being linear, which is in accordance with theory. In cases where gas is given off the equation is

$$E_o - E = A\,k\,p + c\,p,$$

c being very small; that is to say for moderate pressures the variation of force follows a natural logarithmic curve.

Electricity in Mining.—II.

ROTARY MACHINES.

The rotary coal cutters generally make a cut of from 4 to 6 feet deep, and 3 feet to 3½ feet wide: the height varies between 2½ inches and 4 inches. The machines possess the advantage of being able to do quick work, it being possible to under-cut with them about 120 lineal feet a day of nine hours. With very speedy and light machines this may be increased to 150 lineal feet a day. They have, however, the disadvantage of being very heavy, requiring considerable time for adjusting them and for moving them from room to room. Their weight and height make it furthermore undesirable to work with them in veins less than three feet in thickness.

These machines are generally operated by two men, one attending to the motor and the back brace, the other, the helper, to the front brace, and to shoveling the chips out of the way if necessary. For moving the machines from room to room they are placed on small trucks provided with suitable windlass at one end, and preferably with rollers to facilitate in loading and unloading.

There are three different types of this class of machinery in this country. Those using the cutter bar are the Jeffrey, Edison and the Stine-Smith. Those using a battery of drills are the Hercules and Thomson-Houston.

JEFFREY ELECTRIC COAL CUTTER.

The machine consists of a bed frame composed of two steel channel bars thoroughly braced, the top plates on each forming racks with teeth downward, into which the feed-wheels of the sliding frame engage.

Mounted upon and engaging with this bed frame is a sliding frame similarly raised, consisting mainly of two steel bars upon which is mounted, at the rear end, the electric motor, from which power is transmitted by straight gears and worm-wheels to the rack by means of which the sliding frame is fed forward. Upon the front end of this sliding frame is mounted the cutter bar, held firmly by two solid steel shoes, with suitable brass boxes. The cutter bar contains steel bits, made of tool steel, held in place by set screws. When the cutter bar is revolved these cutters or bits cover its entire face. The cutter bar is revolved by an endless curved link steel chain from the driving shaft, and as it is revolved is advanced by the above mechanism into the coal, or other material to be undercut, to the desired depth. The feed is thrown on and off by means of a lever.

The machine is built very strong, and it owes its success mainly to this feature.

The Jeffrey machine seems to have met with very great success, from the fact that there are more of this type of apparatus now in actual operation than any of the others. These machines were introduced in April, 1889, since which time the Jeffrey company have installed 16 plants comprising 46 mining machines doing daily work. Further information concerning this type of machine will be found in the paper by Mr. E. B. Richart, electrician of the Jeffrey company, published elsewhere in this issue.

EDISON MACHINE.

The Edison General Electric Company has on the market a coal cutter which embraces all the fundamental principles of the cutter bar machine. The Edison coal cutter has been thoroughly tested and in use for years. The proper distribution of material to give the machinery the necessary strength and rigidity secures to it the advantages of maximum strength and minimum weight. In this machine the cutter bar revolves in such a direction that the coal is cut upward. This method greatly assists the weight of the machine in holding it down to the ground and to a great extent avoids the necessity of carefully fastening it by means of braces or jacks.

Among other features are a countershaft behind the cutter bar to which the power is transmitted direct from the motor by means of four chains; simplicity in design of the feeding devices; the use of rollers for the sliding frame and the protection of the teeth, which prevents dust from settling between them. The Edison company has in operation several of these machines and is now experimenting on other types.

HERCULES COAL CUTTER.

This cutter was the first auger machine built in this country. It was designed in Pittsburgh and at first intended to run by compressed air. It is now run by electricity, a Tesla motor being generally used. The motor is attached to the machine itself, but operates by means of a belt and tightening pulley. The machine has been in successful operation for a number of years and from 10 to 15 are in use at the present moment.

One man only is required to operate the cutters in the mine of the First Pool Monongahela Gas Coal Company at Willock, Pa., but this is owing to the fact that the bearing-in seam is 12 inches above the ground. Whenever the cut is made near the floor it would require two men as with the usual machines, one to operate and one to shovel the coal from underneath it.

	No. of machines at work.	No. of cuts made.	No. of machine hours run.
July 1	5	113	35½
" 2	4	119	34½
" 3	4	107	29
" 7	4	117	32½
" 8	4	109	31
" 9	4	140	37
" 10	4	127	34½
" 11	4	134	35½
" 12	4	135	35½
" 14	4	130	35
" 15	4	134	36½
" 16	4	134	36
" 17	4	140	38
" 18	3	55	14
" 19	3	31	8
" 21	3	69	17
" 22	4	81	20½
" 23	4	101	29
" 24	4	134	36
" 25	4	69	19
" 26	3	45	12½
" 28	4	124	35½
" 29	4	103	28½
" 30	4	75	21
" 31	3	55	16½
Aug. 1	4	118	30½
" 2	4	124	33½
" 5	4	116	35½
" 6	4	127	34
" 7	4	141	36
" 8	4	130	38

STINE-SMITH COAL CUTTER.

The Stine-Smith coal cutter is undoubtedly an excellent machine, and is sufficiently developed to allow it to be considered commercially successful, some of the machines having been in use for years doing good work. A good view of this machine is given herewith, the cut being made from a photograph. The main features of the Stine-Smith machine are as follows: It has a stationary, well braced frame in which a sliding frame moves on grooved castors; this slide carries at one end a cast steel bedplate to which the motor and different shafts are attached. The power is first transmitted from the motor to the main shaft, and from this by means of gears to a countershaft. Both these shafts are at right angles to the axis of the machine (*i. e.*, parallel to the coal), and carry worms of large diameter, which gear to worm wheels running loose on a short shaft in the centre and parallel to the axis of the machine. A clutch attaches either one of these worm wheels to the feed shaft, thus giving the forward and backward motion required for the feed. The different speeds at which the main shaft and countershaft run give the cutter a slow forward and quick return motion. The feed shaft carries on its rear end a worm six inches in diameter, which engages with a screw rack in the centre of the machine.

THE THOMSON-HOUSTON "MOWING MACHINE" COAL CUTTER.

The weight of the machine with a 15-h. p. motor is 2,400 pounds. It is handled with ease by two men.

The feed mechanism of this machine possesses exceptional advantages. It consists merely of three worms, two worm wheels, one screw rack, with the usual clutches. Instead of having to rely on one chain only, four small chains are used, with the result that during the four years the Stine-Smith coal cutter has been in operation not a single chain has been broken.

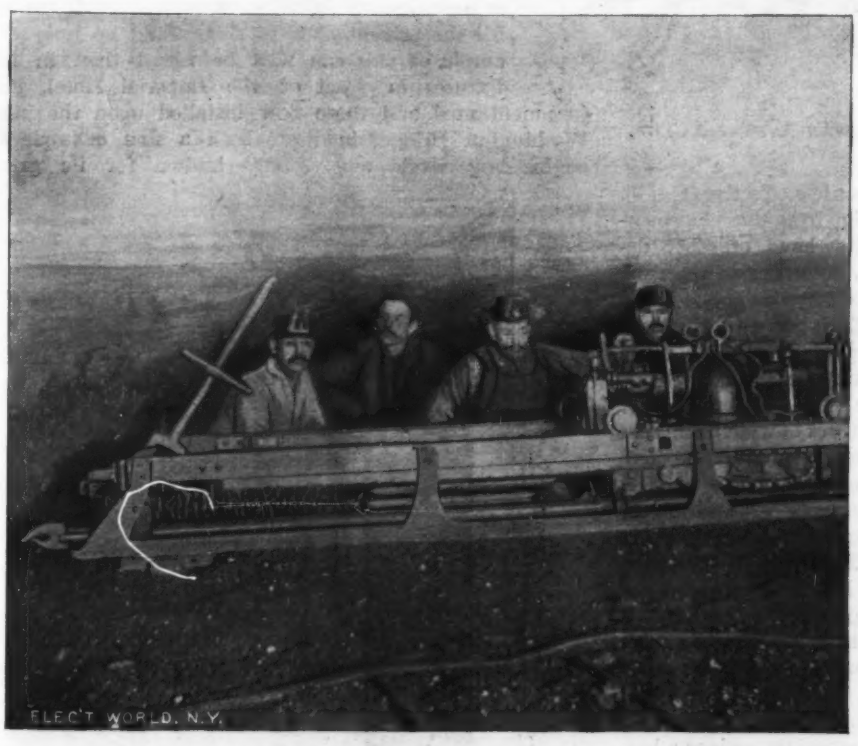
As in the Edison machine, one of the great advantages of this apparatus is that the cutters cut upward. The resistance of the coal, therefore, presses the machine down against the ground, and this, together with its weight, holds it well to the floor and up against its work. The machine therefore does not have to rest on four points, as the pressure due to the jacks is not sufficient to warp it out of shape. This means quite a considerable saving in the time required for setting the machine.

THE PUNCHING MACHINE.

With but few exceptions, the most notable being the new electric attachment of the Thomson-Houston company, the machines belonging to this class of coal cutters are at present run by compressed air. They have, however, the disadvantage of being much slower than the other machines, their maximum performance being from 60 to 80 lineal feet a day, 4½ feet deep. They are, however, easily handled and moved, do not have to be fastened in a certain position before starting to work and can be operated from a platform, as is usually the case; they can be worked in coal containing many sulphur balls, which would prevent the use of other machines, and make more pea and nut coal than these, which is in some cases considered a great advantage. They can furthermore be used for shearing, that is, to loosen the sides of the coal in addition to undercutting. It is true that occasionally occurring sulphur balls or steaks can be cut by any of the machines of the rotary style, but only at the expense of time and cutters. The principal machines belonging to this type and using electricity are as follows:

The Walter electric coal cutter.
The Thomson-Houston solenoid single drill type.
The Michales electric mining machine.
The Sperry mining machine.

Machines of all the foregoing makes are in practical operation in different parts of the country and good work is being done by them. A description of the operation of the Michales electric mining machine will give a good idea of the principle of this class of apparatus.



A ROTARY ELECTRIC COAL CUTTER AT WORK.

The Michales electric coal cutter is of very simple and strong construction, and if any mistake has been made in its design it has been on the side of too great strength, if that were possible. It is operated by a 3-h. p. Tesla motor mounted on the machine with its shaft parallel to the striking bar. This motor is geared to a countershaft underneath it, and the latter is geared to a very strong wheel, carrying a circular cam in general appearance not unlike the tooth of a coupling, intended to transmit motion in one direction only. To the striking bar which passes through this wheel is attached a roller, which engages with the cam and by means of which the rod is pushed back against the pressure of the spring, until, the roller reaching the end of the cam, this spring shoots the striking bar forward again, thus striking the blow. A short but very strong spring is used as a cushion, whenever the pick falls short of the coal. The striking bar carries on its inside end a crosshead, moving in slides; its other end carries the pick. In the old style of machine the frame is made of cast steel, and the slides for the crosshead and the back bearing of the striking bar are attached to it by means of bolts and stayrods. In a new machine they are building this is cast in one piece; the casting weighs 300 pounds, and has suitable places provided for the attachment of the motor and the bearings of the countershaft. This simplifies the machine considerably, so that, not including the motor, it probably could be manufactured within $100.

The design of the machine is such that it is not liable to give out, the only weak point being the spiral springs. The one which strikes the blow has an inside diameter of 3½ inches, and is made of half-inch round steel, being 19 inches long and having about 15 turns. The stroke of the machine is eight inches, and when it does not strike the coal the blow is taken up by the short cushioning spring, compressing the latter about an inch and a quarter. From test cards it appears that 9,000 pounds are required to do this. Both these springs are well protected by a tube screwed into the back bearing of the striking bar and carrying another bearing for the latter in front. The main spring, when in position, is under an initial pressure of 50 pounds. It is claimed that so far only two springs have been broken and that one has worked for three years. Their cost is said to be 10 cents a pound. The machine is mounted on two wheels and weighs, with motor, 700 pounds, striking 145 blows a minute.

The blow of this machine is more powerful than that of the average Harrison machine, and owing to its having but a slight recoil it is much easier handled by the operator, so that blow for blow being equal, more work could be done per day with it than with the other. In operating it the machine can be held with one hand only, the wheel being blocked in the usual manner with the foot. Being, therefore, able to at all times use one hand to help him, the operator is able to get around quickly on his platform. This machine has been compared with the Harrison, using the latter as standard, as this is undoubtedly at present the best and most extensively used machine of this class using compressed air.

The coal in the mine at Essen, in which the machine is in operation, is of very favorable nature to the use of punching coal cutters, as, although it is very hard, yet it is very brittle, so that one well directed blow will cause a large mass of coal to splinter off. The machine made a cut of 3 by 4½ feet in 11 minutes 15 seconds. It is said to be capable of cutting 4 rooms a day, each room being 21 feet wide. This represents about 380 square feet per day.

From the compression given the cushioning spring and the pressure required to compress the main spring 8 inches it appears that the machine would require about 3 h. p. to operate it.

For several reasons it is not very easy to give a good comparison between the capacities of the two styles of coal cutters. First of all, the conditions in mines vary, and one may be best adapted to the use of a rotary coal cutter, whereas another would permit the use of a punching cutter only. In one and the same mine the conditions may be such that, although as a rule a rotary cutter may be preferable in many places on account of too frequently recurring sulphur balls, either the pick or the punching machine would have to be resorted to. The best policy in such a mine would be to have machines of both styles.

By comparing the output as calculated from the performance of the machines while being timed with a real output a day, it will be seen that the latter falls very short of the former. One explanation of this given was that the output was purposely being kept down by the miners in order to keep up the prices paid to the machine man.

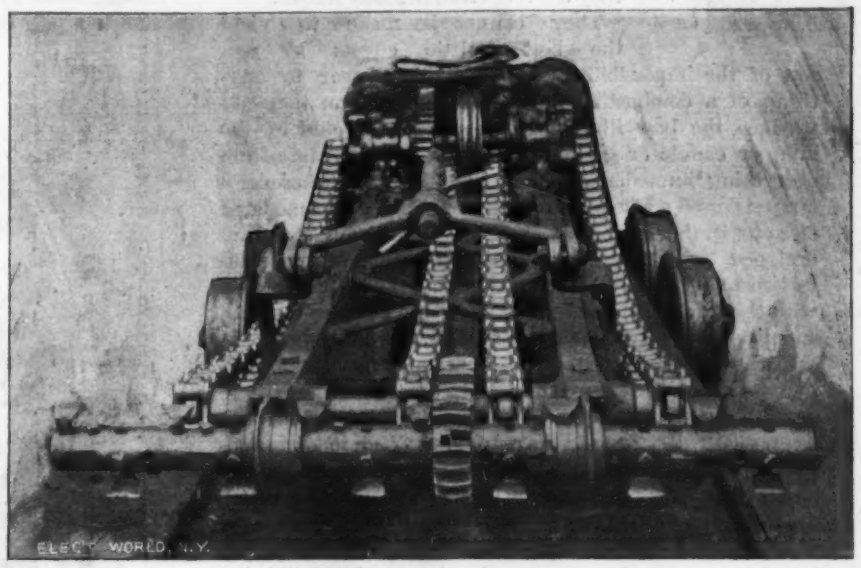
"MOWING MACHINE" TYPE.

Of quite a different design from all the others we have noticed is that developed by the Thomson Van Depoele Mining Company, and known as the New Arc coal cutter. A view of this apparatus is given herewith.

This machine is particularly well adapted for long wall work, although it can be used for room working also. The principal advantages of this type are that it travels continuously while cutting, there being no time lost in withdrawing after the cut is made. It contains two sets of gears, one starting from each end of the armature shaft. The first one operates the chain feed that moves the machine along the wall, and is under the control of the operator. It also actuates the arm about which the knives revolve, bringing it from a position parallel to the cutter, when first started, to a position nearly at right angles when moving along the face of the coal, as shown in the illustration. The second train of gears operates the endless chain holding the cutting knives.

The length of the room is varied with the thickness of the vein to be cut, so that the depth of the undercut is usually made about equal to the width of the vein. The height of the cut is from three to four inches, making very little slack, the knives removing the same as they pass outward, and leaving a clean space.

The machine is provided with two sets of wheels, one at rights angles to the other. The first set are made for the regular mine gauge, and used for moving the machine about the mine.



THE STINE-SMITH COAL CUTTER.

By a cam and lever the machine can be shifted to the other set of wheels, and changed from a forward direction to either side, at right angles. The important advantage of this is that it does away with "skidding," or pushing the machine about the floor, which, as any practical miner knows, is a difficult operation in a four-foot room.

The machine weighs about 3,000 pounds. Its height is 23½ inches. Two men are required for its operation. The apparatus is operated by a specially designed motor of 15 h. p. maximum capacity. One of these machines has been working for some time at the Mead Run mine, near Shawmut, O., and is giving excellent results.

Dinner of the Magnetic Club.

About 130 members and invited guests sat down to the recent dinner of the Magnetic Club, and the affair was much enjoyed. Representatives were present from the Gold and Stock Insurance Association, New York Telegaphers' Aid Society, Serial Building Loan and Saving Institution, and the Telegraph Club. Among the invited guests present were: A. R. Brewer, secretary of the Western Union Telegraph Company; W. J. Dealy, manager New York office of the Western Union Telegraph Company; E. E. Brannin, president of the New York Telegraph Club, and W. H. Baker, vice-president of the Postal Telegraph Company. The large table was arranged in the form of a horseshoe magnet, and above the guests' table swung the pointed inquiry "Are you happy?" to which everybody seemed to reply in the affirmative. The dinner was a sequence of the Telegraph Mutual Benefit Society's meeting held the same day at the Western Union building, and the spirit of fraternity and mutual aid permeated everything. President E. C. Cockey in a neat speech expressed the sentiment of the occasion when he said: "The keynote to-night is fraternity, and this our third autumn meeting is the fraternity meeting. There is no business or calling that can boast of so many societies as the telegraph service, and this club organized to foster sociability among its members claims to be one of them, and it cannot and does not fail to recognize their value to the craft. Fraternity is the great principle that was laid down at the beginning of the social system. 'Love one another' is a maxim as old as the Christian era, and it is this spirit indeed that forms the groundwork of all our happiness."

The "C. S." Combination Lamp Shade and Holder.

A new lamp shade has just been placed upon the market by the Cutter Electrical and Manufacturing Company, of Philadelphia, which is made of aluminium and glass and weighs less than five ounces.

The shade may be described as a combination of a parabolic with a plane radiating reflector to which is attached a diffusion plate of ground glass, and the arrangement of these different parts is such as to direct the main portion of the rays of light into a given zone of illumination, while a minor portion is radiated and diffused throughout the room.

The diffusion plate is affixed securely to the radiating portion of the shade by means of a simple interlocking device, which permits of an easy separating of the two parts when it is necessary to remove or replace a lamp.

Electric Fixtures for Exterior Illumination.—I.

THE art of artistic illumination, from the days of the Roman lamp and the mediæval candle up to the beginning of the past decade, was not only hampered by traditions, but bound by natural limitations from which it could not well escape. The naked flame imposes necessary conditions from which the highest skill of the artist cannot entirely relieve it. Lamp, candle, gas flame, all alike turn their flickering shapes upward, pouring out noisome streams of burned out air, even if they are free from noxious smoke.

They cannot be made to yield the best artistic effects by reason of the impossibility of placing them near to anything of a combustible nature, any more than they can produce the best illuminative results on account of the lamp or candle or gas pipe that shuts off the blaze from everything immediately below it; and besides wherever a lamp is used a reservoir for oil must be accommodated close to it, thrusting its unsightly bulk into any structure designed to remove the light from the realm of pure utilitarianism into that of art. The same is true of candles, with their dripping grease, and even the gas pipe does not end itself with great readiness to elaborate decoration.

With the advent of the electric lamp all this was changed, for not only can this source of light be turned indifferently in any direction, up or down or sideways, but it is effective in any position, does not run the risk of inflaming its surroundings, however gauzy and combustible they may be, and besides distributes the light far better than anything which the ingenuity of man has produced up to the present time.

All this is true whether the illumination to be effected is interior or undertakes the more serious task of lighting streets, entrances, and the exteriors of buildings; for these uses, so long as flames of any description were employed, they were of necessity encased with rigorous completeness to prevent the wind from blowing them out, and the smoky lantern thrust its grimy shape into every attempt to make exterior lighting either harmonize with its surroundings or evolve from the stern necessity of light anything in itself intrinsically beautiful.

The electric light, occupying in itself the minimum of space and connected only by slender wires with its source of supply, lends itself most readily to every sort of illuminative art; while for exterior work it can be used, if needful, unshielded, or concealed in lanterns, unlimited in shape or material by the necessity of avoiding flame.

The modern houses of New York, with their elaborately designed entrances and graceful fronts, afford most striking

Fig. 2.—Entrance to the Holland House.

examples of the artistic use of the electric light, treated as a part of the general architectural effect. A walk through any of the principal streets will show numerous examples of all this and a few typical specimens are shown to our readers here, exemplifying what has been said and the possibilities of even greater development.

Strolling up Madison avenue one instinctly glances, in passing the beautiful club house of the Manhattan Athletic Club, at the symmetrical arched entrance, perhaps as elegant an architectural effort as anything that can be seen in any modern New York building. At the side of the entrance stands a tall wrought iron post simple in design but still with gracefully curved strands and all the details of elaborate workmanship. Coiled about it and craning its ugly neck about the top is a carefully wrought griffin, its ugly aspect quite sinking into insignificance the gargoyles above, and leering with evil mien at the belated club man, who rubs his eyes and shivers at the uncouth apparition.

His griffinship has closed his jaws over a curved arm from either end of which depends an openwork lantern of daintily wrought ironwork (Fig. 1). Within each glows a fifty candle power lamp, through a globe of opalescent glass, while above all at the top of the post is a somewhat conventional lantern—too reminiscent, perhaps, of the old days of gas—and holding three ordinary glow lamps. The whole, designed by Messrs. Oxley, Giddings & Enos, of this city, is a striking specimen of artistic ironwork, and is one of the first of the modern electroliers to be applied for exterior lighting.

Passing down the avenue, in front of the mansion at No. 23 stands a pair of fixtures less grotesquely archaic and

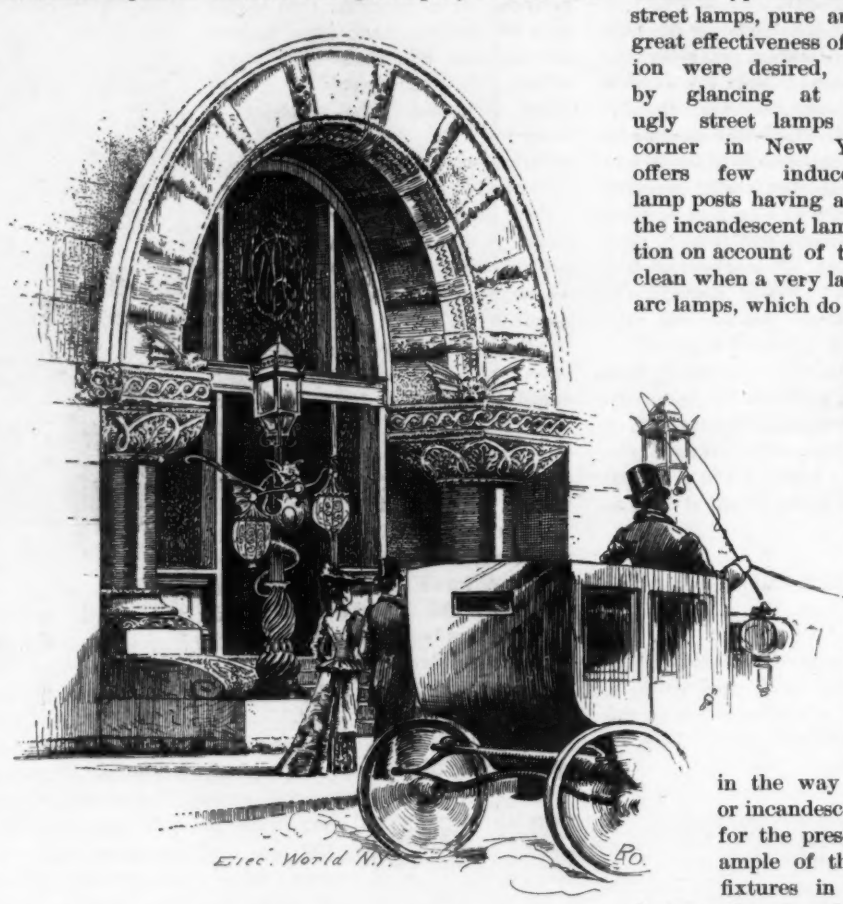


Fig. 1.—Entrance to the Manhattan Athletic Club.

somewhat more conventional but not less effective (Fig. 3). They show a wide divergence in design from those last mentioned, and, indeed, were from the hand of other designers—Messrs. J. W. Fiske & Co., New York. They too, however, are of wrought iron, gracefully fashioned into a pair of pillars nearly 10 feet high. Each bears a square lantern, and a cluster of lamps sends a cheerful glow down upon the sidewalk and over the beautiful entrance.

Crossing over to Fifth avenue one sees at the entrance of the new Holland House exterior fixtures of widely different character from those mentioned, though no less effective and beautiful. The Fifth avenue entrance of this hotel is covered by an arcade supported by four columns, and against each of these is placed a glowing lantern. Two only are shown in the illustration, Fig. 2. The fixtures in design are totally distinct from those we have as yet seen, for against each post is perched a huge griffin of the form which from mediæval days has been connected with the architecture of entrances. It is an uncanny creature, half eagle and half lion, of the form to which tradition has ascribed the guardianship of hidden treasures.

From the beak of each of these monsters swings a lantern, not of any conventional type, but a great globe of opalescent glass carrying a cluster of lights that cast a soft and delicate light over the passer by. These particular fixtures are from the workshop of the Edison General Electric Company, alike responsible for the lamps and the structure that bears them. They are of monumental bronze, often preferred to iron for external work on account of its great durability and the beautiful color with which the hand of time adorns it.

All through this and other cities may be found to-day similar examples of decorative lanterns. The artistic fancy of each designer finds scope to evolve original forms, and it must be remembered that fixtures designers form to-day a little group of artists of striking ability and ingenuity.

A striking form of a totally different style from anything that we have been considering, from the workshop of Messrs. Archer, Pancoast & Co., of this city, may be admired in front of the entrance of the apartment house at No. 127 West Fifty-eighth street (Fig. 7). Like very many of the other exterior fixtures, the material is wrought iron, but the style is that of the later Renaissance, an elaborately ornamented column bearing on its top a group of 11 lanterns arranged as in some antique candelabra, and all glowing with globes of incandescent lamps. Six of them are of opalescent glass, spherical and spirally ridged, while the other five—and this is perhaps the only feature of the fixture to be criticised—are square and of almost the Colonial type, harmonizing with the architectural fad of the present day.

In front of the Imperial Hotel, at Thirty-second street and Broadway, itself one of the most elegant of the modern New York buildings, rise four ornamental columns capped by lanterns affording a very striking example of the artistic form that may be given to what is properly a street fixture. They were planned by the designer of Messrs. J. B. & J. M. Cornell, at whose ironwork shops they were built, and the general arrangement is that of a wrought iron Corinthian column 14 feet in height (Fig. 5).

These columns rest on balls borne by a hexagonal block of wrought iron that forms the foundation, and about each is wound two spiral wreaths of conventional laurel leaves, crossing each other at regular intervals from base to capital. The lantern itself is particularly artistic in plan, of the Colonial type and hexagonal in general form. These are street lamps, pure and simple, and if any evidence of the great effectiveness of the electric light for street illumination were desired, it can be found readily enough by glancing at these and then at the bare, ugly street lamps that disfigure nearly every street corner in New York City. True, the gas light offers few inducements for the construction of lamp posts having any beauty to recommend them, while the incandescent lamp is not a favorite for street illumination on account of the care required in keeping the globes clean when a very large number are in use; but even the arc lamps, which do not suffer from this cause, by reason of being comparatively few in number, and can be the more easily made ornamental as well as useful, are at present installed for the most part in iron structures of peculiar plainnesss. This is the less excusable as an arc light can be rendered both more ornamental and more effective optically by being placed in an enclosing globe that will serve to scatter the lights. This has been done in lighting the streets of the city of London, and although the lamp posts there are not by any means as artistic as they might easily be made, they are still infinitely better than our own. Enough has been done in the way of ornamental posts for either arc or incandescent lights to show the small excuse for the present state of things, and no finer example of this can well be found than in the fixtures in front of the Imperial Hotel, just just mentioned, and those now installed upon the great Washington Bridge, in itself both a fine example of engineering work and widely known for its great

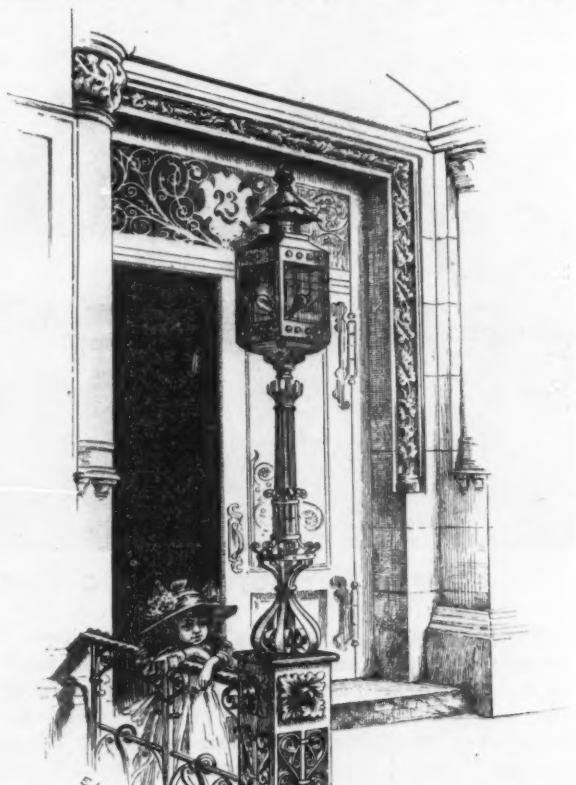


Fig. 3.—Entrance to a Madison Avenue Residence.

beauty of design. High above the river, and rising a dozen feet above the parapet of the bridge, ranging along both sides through its entire length, are a series of beautiful bronze posts, one of which is shown in Fig. 6. Sentinel like they stand ranged along the bridge at regular intervals and casting a warm light over the roadway and visible for miles up and down against the evening sky. The columns themselves belong to that mixed order that followed the decadence of the purer Greek styles, although the capitals bear a faint semblance of the Ionic. The lantern is unusually large, contains a cluster of brilliant lamps, and is more ornate in design than the column itself.

Altogether these fixtures, designed by Messrs. Iden & Co., New York, furnish the great bridge with a singularly ornamental and harmonious illumination.

So far we have been considering only exterior fixtures which can be readily visited in New York during a single evening. It is not in this city that the designers' art has done perhaps the most toward the development of the beautiful in illumination, but the example of the work done here has made itself felt elsewhere, and all over the country may be found to-day fixtures from the leading houses of the East. Indeed, in the West are now some very beautiful examples of exterior illumination, and the Chicago Exposition of 1893 will presumably give work of this kind an impetus which will long be felt.

One of the finest examples of artistic designing that has been recently sent West was furnished by the W. C. Vosburgh Manufacturing Company, of Brooklyn, for the Vanderburgh County Court House, of Evansville, Ind., shown in Fig. 4. It is a newel post light, of graceful form and elaborate finish, and stands in one respect widely apart from anything we have as yet seen. The material in the main is cast brass, but the finish of most of the details is oxidized copper, the two contrasted colors producing a most pleas-

FIG. 4.—FIXTURE DESIGNED FOR THE EVANSVILLE (IND.) COURTHOUSE.

ing combination and adding greatly to the effect of the whole. The design resembles a huge ornamental lamp having at the top both a lantern and four incandescent lamps turned gracefully downward at its corners. The employment of more than one material is an excellent feature of some modern electroliers and might be carried much further than it is with admirable results. Numerous metals and alloys can be combined with very beautiful results. Among them may be mentioned aluminium, which is particularly well suited for decorative outside work on account of its freedom from the action of the atmosphere. Of course its price might prevent its employment for massive castings, but it might certainly be used for ornamental details and applied work with the greatest readiness.

Most of the exterior electroliers that we have described are of imposing dimensions and suited particularly for use at the entrances of great buildings and in situations where a massive as well as an ornamental effect is necessary to the surroundings.

In the continuation of this paper there will be described fixtures no less beautiful, but of size and character more suited to general use. Of these an immense variety have been manufactured, and of necessity such a description will have to be confined to a few typical examples of the best that has been done in this special line of artistic metal working.

(*To be continued.*)

FIG. 5.—FIXTURE IN FRONT OF THE IMPERIAL HOTEL

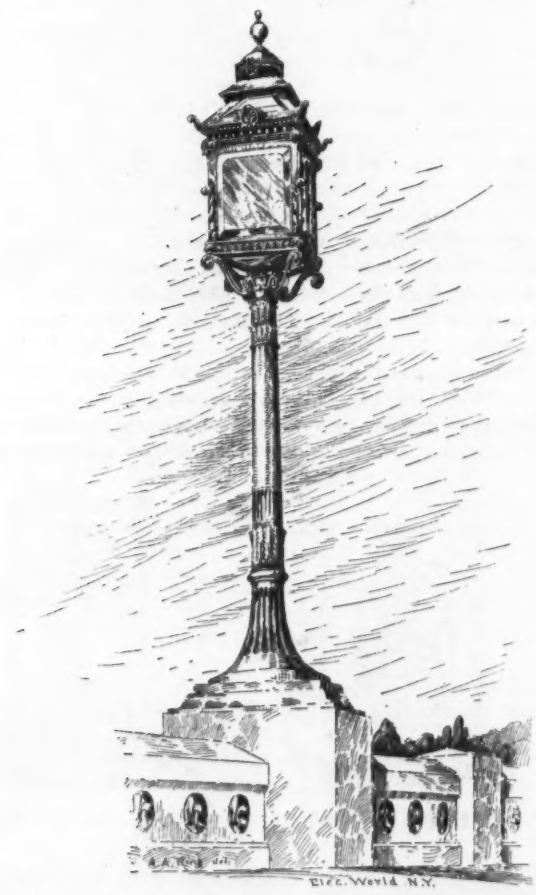


FIG. 6.—FIXTURE ON THE PARAPET OF THE WASHINGTON BRIDGE OVER THE HARLEM RIVER.

(*Copyrighted, 1890.*)

Chronological History of Electricity, Galvanism, Magnetism and the Telegraph, from B. C. 2637 to A. D. 1888.—Part I.*

BY P. F. MOTTELAY.

The following is also extracted from Prof. Moll's interesting paper: "Mr. Biot, in his treatise on Natural Philosophy (tome III., p. 143) asserts that we are indebted to Cassini IV. (see Jean Dominique, Comte de Cassini, at A. D. 1782–1791) for much of what we know even about the diurnal variation of the needle. This, I think, is not fair. We do not mean to undervalue Mr. Cassini's observations, but it is unquestionable that long before the publication of that philosopher's work, Mr. Van Swinden had observed and published ('Recherches sur les aiguilles aimantées et leurs variations'—Mémoires présentés à l'Académie des Sciences de Paris, tome VIII., prize essay 1777) that which Mr. Biot less accurately is pleased to ascribe to his countryman. In this respect, however, Mr. Van Swinden was treated with more justice by other eminent French philosophers, such as Haüy, Halley and Burkhardt." (See also the "Acta Acad. Petrop." for 1780, part I., Hist. page 10).

In the aforenamed very meritorious work, "Recueil de Mémoires," etc., crowned by the Bavarian Academy, Van Swinden has treated fully of the then current theories relative to electrical and magnetical phenomena, reviewing the entire field of their application. In so doing he has necessarily made numerous references to discoverers and experimenters of all countries, the names of many of which appear in this "Chronological History," and while it is, of course, useless here to quote these anew, it has been thought best, for a record, to specify such references as are infrequently met with, and which appear in many of his most important articles, even at the risk of being accused of diffuseness or prolixity. They are as follows: John T. Needham (vol. IV., Mem. Brussels Acad. for 1783; *Phil. Trans.*, 1746, p. 247; J. G. Lehmann ("Abhandlung von Phosph."; "Von Magnet Theilen im Sande," "Novi Com. Acad. Petrop.," vol. XII., p. 368, etc.); M. De La Cépède, "Essai sur l'El. nat. et artif."; C. E. Gellert ("Com. Acad. Petrop.," vol. 13, p. 392, Exp. 15, 16); J. F. Henckel, "Pyritologia, etc."; J. E. Von Herbert, "Theor. Phaen. Elect.," cap. 4, prop. 8; C. F. M. Déchales, "Mundus Mathematicus," lib. I., *Quartus Exper. Ordo.*, exp. 16, tome II., p. 488, Ed. 2, etc.; M. Marcel's Dissertation on powdered magnets, which appears in the Dutch "Uitgeleeze Verhandelingen," vol. I., p. 261, etc.; Jean M. Cadet ("Nova Acta. Physico. Med. Accid. Natur. Curios.," tome III.): Abbé Giraud-Soulavie ("Comment. . . . Œuvres de Mr. Hamilton," note 4, p. 303); J. B. Le Roy ("Mém. de l'Acad. de Paris," for 1753, p.

FIG. 7.—FIXTURE IN FRONT OF AN APARTMENT HOUSE IN WEST FIFTY-EIGHTH STREET.

447; for 1772, p. 499; *Jour. de Phys.*, vol. II.); Rudolph Richard ("Magazin d. Hamb.," IV., p. 681); Gilles A. Bazin, "Descrip. des Cour. Mag.," plates 14, 16-18; J. F. Gross, "Elektrische Pausen," Leipsic, 1776; *Jour. de Phys.*, vol. X., p. 235; Niccolò Bammacaro," Tentamen de vi Electrica, etc.," § 6; Samuel Colepress (*Phil. Trans.*, 1667, No. 27, vol. 50, p. 502); E. F. Du Tour, "Discours sur l'aimant," § 27; "Recueil des Prix de l'Acad. de Paris," tome V., Mém. II., p. 49; "Mém. Math. et Phys."; Mr. Calendrin, at Van Swinden's, vol. I., pp. 233, etc.; M. Blondeau ("Mém de l'Acad. de Marine," Brest., tome I., § 46, pp. 401-431, 438; J. A. Bracur, "Observations, etc.,"; "Novi. Comment. Acad. Petrop.," vol. VII., pp. 388, 407; M. Antheaulme ["Mém. sur les aimants artif." (prize essay), 1760; "Mém de l'Acad. Roy., 1761, p. 211; Van Swinden, 1784, vol. II., pp. 95, 170]; J. N. Reichenberger. "Direc. torium Mag., etc.," and "Hydrotica," as at Van Swinden 1784, vol. II., pp. 272-273; Geo. C. Schmidt, "Beschr. einer Elektrisir Mach., etc.," 1778; M. De la Folie (*Jour. de Phys.*, 1774, vol. III., p. 9); Cölestin Steiglehuer, "Obs. phoen. elect.," "Ueber die annal. d. El. v. d. Magu.,"; Lorenz Hubner, "Abh. v. d. Annal. v. mag. Kraft"; Jos. Thad. Klinkosch, "Schreiben, etc.," "Beschreib. d. Volta . . . Elektrophors"; Antoine Thillaye's treatise presented to the Ecolede Médecine le 15 Floréal, An. XI.; Butet ("Bull. des Sc. de la Soc. Philom." No. 43, Vendémiaire, An. IX).

A. D. 1784.——Cotugno (Domenico), professor of anatomy at Naples, thus addresses Le Chevalier G. Vivenzio under date October 2, 1784: "The observation which I

mentioned some days ago, when we were discoursing together of the electrical animals, upon which I said I believed the mouse to be one of that number, is the following: Toward the latter end of March I was sitting with a table before me, and observing something to move about my foot, which drew my attention, looking toward the floor I saw a small domestic mouse, which, as its coat indicated, must have been very young. As the little animal could not move very quick, I easily laid hold of it by the skin of the back and turned it upside down; then with a small knife that laid by me, I intended to dissect it. When I first made the incision into the epigastric region, the mouse was situated between the thumb and finger of my left hand, and its tail was got between the two last fingers. I had hardly cut through part of the skin of that region, when the mouse vibrated its tail between the fingers, and was so violently agitated against the third finger that, to my great astonishment, I felt a shock through my left arm as far as the neck, attended with an internal tremor, a painful sensation in the muscles of the arm, and such giddiness of the head, that, being affrighted, I dropped the mouse. The stupor of the arm lasted upward of a quarter of an hour, nor could I afterwards think of the accident without emotion. I had no idea that such an animal was electrical; but in this I had the positive proof of experience." (See G. Vivenzio, "Theoria e pratica. . . . ," Napoli, 1784, page 157.)

Cotugno's observations attracted much attention throughout Italy and gave rise to many experiments, notably by Vassalli, who, however, merely concluded from them that

Fig. 3.—Static Motor.

the animal's body could retain accumulated electricity in some unaccountable manner.

See *Essai sur l'histoire, etc.*, J. B. Biot, p. 9; *Journal de Physique*, XLI. p. 57; *Mémoires Récréatifs, etc.*, par Robertson, Paris, 1840, vol. I., p. 233; Cavallo, *Electricity*, London, 1795, vol. III., p. 6; Izarn, *Manuel*, Paris, 1804, p. 4; *Journal Encyclopédique de Bologne*, 1786, No. 8; Poggendorff, vol. I., p. 417; Sue, "Hist. du Galv." i, 1.

A. D. 1785.——Coulomb Charles Augustin de), the founder of *electro-statics* and of the school of experimental physics in France, invents the torsion balance, with which he discovers the true law of electric and magnetic attractions and repulsions. By some, it has been asserted that Lord Stanhope had previously established, through actual experiment, the law with regard to electricity, but it does not appear to have been seriously questioned that its extension to magnetism belongs exclusively to Coulomb. It is true that Johann Lamont ("Handbuch . . . ," page 427) gives the credit of the latter discovery to Giovannantonio Della Bella, of Padua, who is mentioned by Poggendorff ("Biog.-Liter. Handwörterbuch," vol. I., page 139) as the author of several works on electricity and magnetism, but the claim is not apparently established upon any satisfactory foundation.

With his balance, or rather electrometer, Coulomb measures the force by the amount of twist it will give to a long silken thread carrying a horizontal needle, made, preferably, of a filament of gum-lac or of straw covered with sealing-wax. From his experiments he reached the following conclusions: That the attractive force of two small globes, one electrified positively and the other negatively, is in the inverse ratio of the squares of the distances of their centres, and that the repulsive force of two small globes, charged either with positive or negative electricity, is inversely as the squares of the distances of the centres of the globes. ("Mém. de l'Acad. Roy. des Sciences," 1784, 1785.)

In one of his three memoirs to the French Academy during 1785, he states that a balance used by him was so delicate that each degree of the circle of torsion expressed a force of only one one-hundred-thousandths of an English grain, that another, suspended by a single fibre of silk, four inches long, made a complete revolution with a force of one seventy-thousandths of a grain, and turned to the extent of a right angle when a stick of sealing-wax, which had been rubbed, was presented to it at the distance of a yard. It is said that a similar electrometer has been constructed in which the movement of one degree recorded a force not exceeding one twenty-one million six-hundred-thousandths of a grain.

A Group of Static Motors.

It has long been known that a static machine can be operated as a motor if supplied with energy from a similar machine. In fact the experiment has been familiar in the lectures on physics at more than one institution, but the

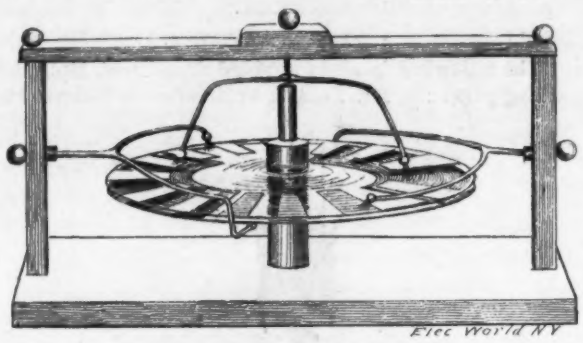


Fig. 1.—Static Motor.

ordinary Holtz and Wimshurst influence machine is mechanically not altogether well fitted for such a purpose, reversible indeed it is, as truly as the dynamo is reversible, but not conveniently. During the past summer Mr. Wimshurst devised a form of influence machine that lends itself with special readiness to use as a motor, and attracted some little attention in England. Recently, working along the same lines, Mr. William McVay, of this city, has been conducting a series of most interesting experiments with static motors, building various experimental forms, and finally evolving a machine that furnishes a very pretty analogue of the reversible dynamo. The motors built by Mr. McVay thus far have been five in number, the earliest one, shown in Fig. 1, is derived from the ordinary inductive generator, consisting, as a glance at the cut will show, of a couple of plates of glass, one stationary and the other rotating on the vertical axis above it at a distance of perhaps an eighth of an inch. The lower stationary disc bears two quadrants of tin foil, the upper 16 sectors about three inches long and shaped as shown in the figure. The spindle on which the upper disc rotates is of hard rubber and the connections are very simple. Each pole of the Wimshurst machine that serves as agenerator is connected to an arm bearing two brushes, one touching continually one of the lower quadrants, the other charging a sector on the upper disc just clear of the edge of the other quadrant, which of course is of opposite polarity. The pole is similarly connected, and nearly midway between the brushes that charge the sectors is an equalizer as on the Wimshurst machine, consisting only of a wire with a brush at either end touching simultaneously opposite segments. The operation is plain. Each sector as it approaches a quadrant is charged with electricity of opposite polarity, attracted, and discharged, together with the diametrically opposite segment, by the equalizer as it passes the further edge of the quadrant. The direction of revolution of the motor can be reversed by connecting both sides of the charging brushes with one pole of the machine and grounding the equalizer. In this case repulsive effect is utilized and the charge taken to ground through the equalizer.

Motor No. 2 as constructed by Mr. McVay is practically the same thing, two glass shades being employed instead of the discs, the inner one carrying the quadrants being stationary, the outer and revolving disc being armed with sectors as

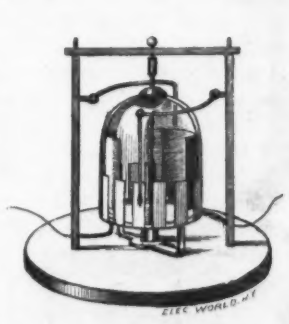


Fig. 2.—Static Motor.

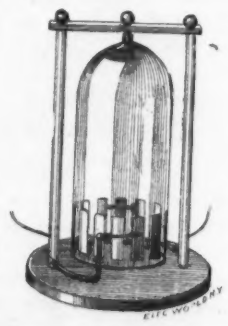


Fig. 4.—Static Motor.

before. In this case the connections with the quadrants are through the base of the machine.

Motor No. 3 was an evolution along the same line. The inner glass shade is replaced by a battery jar, carrying on its top a support for the spindle on which the outer shade revolves. The contacts with the sectors are brought up to the neck of the shade, where also are placed the equalizer brushes, forming as it were a sort of rude commutator. This was a distinct improvement of Fig. 1, and runs with the greatest facility.

In Fig. 3 Mr. McVay struck out along a new line and one which is really much more instructive than any of the designs just mentioned. It is simplicity itself, consisting merely of a revolving shade as before, armed with sectors of tin foil. The metallic posts on either side form a support for the quadrants of the machine, as will be readily seen from a glance at the cut. The connections charge with electricity of the same sign a given supporting post and a sector close to the opposite post, the result is that this sector is attracted, and as the shade turns another is charged to be attracted in turn. No equalizer is employed, and the air is relied on to carry off the charge with sufficient rapidity.

Fig. 5 is the latest stage of the evolution of the static motor up to date and is virtually the same as Fig. 4, except arranged on a horizontal instead of a vertical axis. In this case the cylinder is of hard rubber six inches long by four and a half in diameter, with brass sectors nearly the entire length of the cylinder and three-quarters of an inch wide. A three-sixteenths of an inch steel rod forms the bearings. The support for both cylinder and inductors is of hard rubber. The inductor rods, as in the previous design, are covered with insulating material, but run somewhat closer to the cylinder. The principle is exactly the same as in the previous machine, but so effective is this form that it is employed to rotate a Geissler tube carried by the axis of the cylinder. Twice in every revolution by touching the balls shown in the figure this tube receives the discharge and is brilliantly illuminated. It may be remarked that this final form of motor possesses strong points of similarity to an electric motor of the ordinary kind, the inductors corresponding to the pole pieces—they are in fact pole pieces. The armatures on the cylinder and connections are very much in principle like those employed in some of the old electro-motors where fixed electro-magnets attracted others placed upon a rotating armature. Mr. McVay is now elaborating the design of this last motor with a view of obtaining greater power and efficiency by providing an equalizer brush to discharge each armature as it passes the pole piece, and thus utilizing its repulsive effort as well as the attractive one of its successors. The form is also to be somewhat changed, so as to present even a more striking analogy with the electric motor.

Of course it is understood that these machines are intended simply for experimental and instructional pur-

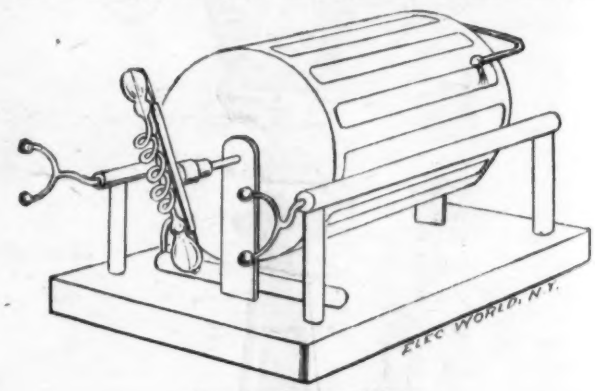


Fig. 5.—Static Motor.

poses, and they are well adapted to give many a student plenty of new ideas on the subject of so-called "static" electricity.

Formation of the Canadian Electrical Association.

During the Industrial Exhibition last September a meeting was held in Toronto of a number of gentlemen interested in electrical science. They then decided to form an organization, to be known as the Canadian Electrical Association. Messrs. J. J. Wright, Fred Nicholls, D. Thompson, W. A. Johnson, A. B. Smith, H. J. Dunston and John Yule were appointed to draught a constitution, which they did, and presented the result of their labors to the gathering at a recent meeting.

The following gentlemen were present: J. J. Wright, chairman; C. H. Mortimer, secretary; E. S. Edmonson, Oshawa; W. A. Johnson, Ball Electric Light Company, Toronto; T. W. Whiting, manager Bell Telephone Company, Guelph; John Yule, manager Gas and Electric Light Company, Guelph; James Corbett, electrician, Toronto; Fred Nicholls, manager Incandescent Electric Light Company, Toronto; John Galt, M. E., Toronto; H. S. Thornberry, Toronto; A. A. Wright, Renfrew; H. O. Fisk, Peterboro; J. W. Taylor, manager Brooks Manufacturing Company, Peterboro; T. Thompson, Electric Light and Power Company, Hamilton; Thomas H. Woodland, Bell Telephone Company, Hamilton; B. J. Throop, Hamilton; J. Douglas, Kay Electric Works, Hamilton; John Carroll, secretary and treasurer Phillips' Electric Works, Montreal; Hugh Neilson, Toronto; H. J. Dunston, Toronto. Letters of regret were received from Messrs. C. Harris, manager Bell Telephone Company, Halifax; H. Brown, manager St. Thomas Gas and Electric Company; W. J. Gilmore, manager Bell Telephone Company, Brockville; J. S. McLachlan, Hamilton; S. J. Parker, Owen Sound; G. J. Thomas, manager Bell Telephone Company, Essex; W. J. Fraser, Petrolea.

After a constitution and by-laws had been adopted, the following officers were elected: President, J. J. Wright; first vice-president, H. J. Dunston; second vice-president, John Carroll; secretary-treasurer, C. H. Mortimer; executive committee, E. S. Edmonson, Oshawa; H. O. Fisk, Peterboro; W. A. Johnson, Toronto; S. J. Parker, Owen Sound; A. B. Smith, Toronto; D. Thompson, Hamilton; Thomas H. Woodland, Hamilton; A. A. Wright, Renfrew; John Yule, Guelph.

It was decided to hold the first annual meeting of the association in Hamilton on the second Tuesday of June,

1892. The Executive Committee at a recent meeting transacted a large amount of preliminary business. The assembly was enthusiastic throughout. Almost every branch of electrical science was represented. There is every indication that the general meeting will be both interesting and successful.

Test of the New Thomson-Houston Freight Locomotive.

Occurring at a time when the problem of using electricity as a motive power for railroad work is being warmly discussed, the exhibition given by the Thomson-Houston Electric Company of an electric locomotive drawing six freight cars weighing 150 tons, at Lynn, Mass., on the 28th inst., was an event of great importance from both an electrical and railroad point of view. It is the largest electric locomotive ever built in this country, and its successful operation at the test delighted the large number of newspaper men and experts who had gathered to witness what may be the beginning of a new era.

A party of about forty left Boston in two special cars which were attached to the two afternoon trains on the B., R. B. & L. R. R. for Lynn, in charge of the officials of the Thomson-Houston mining and railway departments. Special electric cars were in waiting at Lynn to convey the party to the Thomson-Houston works where trial was to be made.

The first test was made by coupling the locomotive to two cars heavily loaded with iron. These were shifted from one track to another, both tracks being on a 2 per cent. grade, and also on a curve of about 150 feet radius. The total weight of the cars was 54½ tons.

The second test was by coupling on two more cars, making four in all, and shifting them as before. The total weight of the load was 96 tons.

The third and final test was made with six loaded cars handled in the same manner and with apparently as little effort as was required to shift two cars.

The locomotive, which is shown in the accompanying illustration, itself weighs 21 tons. Its general appearance is that of a small steam locomotive without the boiler. The massive iron frame consists of two heavy pieces of cast iron bolted together at the ends. The end plates are provided with heavy spring drawbars such as are used on the heaviest freight cars, while a cow catcher of familiar design is cast, solid with the end of the locomotive.

One motor, having a maximum capacity of 125 h. p., supplies the motive power. This motor is geared to the forward axle by a train of powerful cast steel gears. Parallel rods 1¼ inches by 4¼ inches connect the two axles. The distance between the centres of axles is six feet four inches while the diameter of the drive wheels is 42 inches.

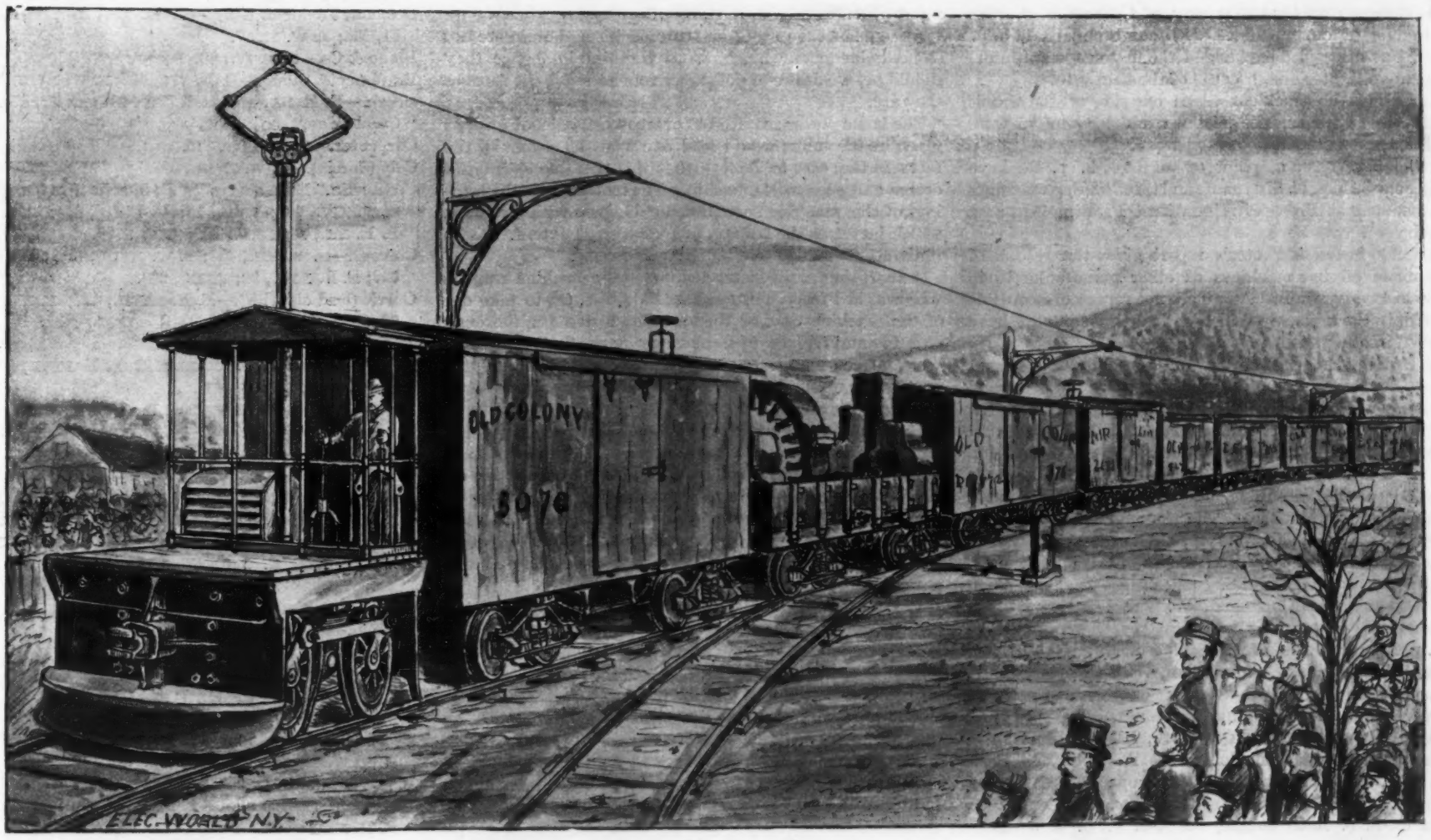
The motor is made with a special waterproof finish throughout designed for the purpose. The armature makes 1,000 revolutions per minute, when the car is running at a speed of five miles per hour. This speed is reduced by the gears from 25 revolutions at the armature shaft to one at the axle. All the gears are of steel, and entirely enclosed in tight iron cases carrying heavy grease. The largest of these, that attached to the axle, has a width of eight inches.

A very powerful brake, consisting of a cast iron drum keyed solidly to the intermediate shaft of the motor, is provided. This is covered with a wooden lagging, and the whole embraced by two steel bands which are tightened by powerful cams operated by a lever in the cab. This brake is sufficient to stop a train of eight cars when going five miles an hour down a two per cent. grade. Sand boxes deliver the sand at the rails directly under the wheels on both sides of the locomotive, thus securing maximum traction effect.

In the cab, or operating stand, is placed the controlling mechanism, consisting of a rheostat, reversing switch, brake and sand box levers.

The current is taken from a trolley wire by means of what is known as the "Universal," trolley, manufactured only by the Thomson-Houston company. The peculiar feature of it is that when the locomotive is reversed it is not necessary to reverse the trolley.

For more than a year this locomotive has been in course of construction for the Whitin Machine Company, of Whitinsville, Mass., where it is to be used for hauling freight cars from the factory to the main line of the railroad, a distance of two miles.



A VIEW OF THE NEW THOMSON-HOUSTON ELECTRIC FREIGHT LOCOMOTIVE.

Some data on the locomotive are given below:

Voltage required for the motor	500 volts.
Horse power at the drawbar	100.
Speed on level track when developing this power	5 miles per hour.
Wheel base	6 feet 4 inches.
Diameter of wheels	42 inches.
Speed reduction between armature and axle	1 to 25.
Gauge	4 feet 8½ inches.
Wheel base	6 feet 4 inches.
Measured height above rail platform	4 feet 4 inches.
Greatest length of locomotive (at cowcatcher)	15 feet 7¼ inches.
Greatest length of platform	7 feet ¼ inch.
Weight of locomotive less trolley pole	42,525 pounds.
Approximate weight of motor	5,400 pounds.

The designing, building and testing of this machine has been done under the supervision of Mr. J. P. B. Fiske, of the Lynn factory, who has in charge all the motor work now being done by the company, except that for railway and long distance transmission.

International Telegraph Statistics.

London *Iron* says that "Luxembourg is the European country possessing the greatest number of telegraph offices in proportion to its superficial extent. It has on the average one of these useful institutions to every 17.16 square miles of territory. In other European countries the proportion is as follows: Belgium, one to 19.67 square miles; Switzerland, 20.24; Germany (including Bavaria and Wurtemburg), 20.56; Great Britain, 26.86; Netherlands, 28.62; France, 34.81; Italy, 48.12; Austria, 51.36; Denmark, 66.05; Hungary, 115.86; Portugal, 193.43; Greece, 218.36; Servia, 260.05; Sweden, 274.19; European Turkey, 277; Roumania, 283.55; Bosnia and Herzegovina, 312.55; Spain, 317.5; Montenegro, 393.05; Norway, 564.93, and, finally, Russia, which (including Siberia) has but one telegraph office for every 3,700.5 square miles of land.

Practical Application of Electricity in Coal Mines.

BY E. B. RICHART.

The annual report of R. M. Haseltine, Esq., Chief Inspector of mines of Ohio, for 1890, published in THE ELECTRICAL WORLD of Nov. 28, devotes considerable space to the consideration of electric power as used in the several mines which have adopted it. It contains a very elaborate table, purporting to give an unbiassed statement of the total electric horse power absorbed by the motor while making a cut, the amount lost in the motor and machine, while running light with the feed on and with it off; the quantity lost in motor and machine while backing out of the cut just made; the net electrical horse power required to make the cut; the time occupied in making the cut, in and out; the horse power required to undercut one square foot in one minute, the speed of armature, etc. There are 22 headings in all; we only refer to a few of them.

The inspector says his object in compiling the table was to determine what became of the power generated in the dynamo room; to locate the losses, which seemed to be considerable, because it was claimed by the manufacturers that 15 h. p. was sufficient to do the work.

He made 41 tests in all, 34 of which were upon machines of our manufacture.*

We have no doubt that Mr. Haseltine believes he has done us entire justice in his report, but there are a few errors in the text, and the table does not really give the machines all the credit they are entitled to.

The above, together with the fact that two of the three expert electricians who accompanied him and actually made the tests were heads of the mining department of two rivals of ours, and that we were not asked to send a representative of our own with them, has induced us to make some corrections in the text of the report, and in regard to the performance of the mining machines as given in the table.

Because of the fact that THE ELECTRICAL WORLD is now read by nearly every mine operator in the country, and as the matter we wish to call attention to concerns our electrical machinery, we prefer to have it brought to their attention through its columns.

Of the three electric hauling locomotives first alluded to, that at the Whippoorwill mine, Shawnee, is a 20-h. p. o our make. It was installed October, 1889 (replacing one o 8-h. p. made by other parties, which had run but a short time), and continued to do satisfactory work until the mine was closed, because of legal difficulties, in the latter part of 1890.

The generating plant, wiring, trolley line, etc., were installed by the same parties who made the 8-h. p. locomotive, the engine being of 60 h. p. and the dynamo 40 h. p. Some eight months previous to the time when our locomotive was started we had put in this same mine two of our mining machines equipped with electric motors, each having a nominal capacity of 15 h. p. and a maximum of 25 h. p. They did their work satisfactorily until the mine was shut

*[Mr. Richart is the electrician of the Jeffrey Manufacturing Company, of Columbus, O.—ED. E. W.]

down in December, 1890. The generator was considerably overloaded, but stood it admirably, and is in good condition to-day.

This mine was leased by Messrs. Opperman and McGrew, and again put into operation last August. The two electric mining machines are doing good work, but because of a change in the location of the opening the locomotive is yet idle.

At the Morris Coal Company's mine at Jobs, O., the generating plant consists of a 150-h. p. Buckeye engine driving two 75-h. p. Edison dynamos, installed by the Sprague Electric Railway and Motor Company.

The company also put in a locomotive, but it has been laid aside for reasons give in the inspector's report. Early this year two additional machines were sold to the Morris company, one each for the Jobs and Sand Run mines. Still another of our latest type was put in at Jobs early in August, making five in all at that mine, and four at Sand Run.

The generating plant at the latter mine consists of a 100-h. p. Buckeye engine and an 80-h. p. United States dynamo. In August of 1890 the mine of the Upson Coal Company, Shawnee, O., was equipped with a 100-h. p. Ideal engine and an 80-h. p. U. S. dynamo, a 20-h. p. electric locomotive and two mining machines. A third machine was added last July. This is a model plant in every way, and has given entire satisfaction to the owners.

The Morgan Run Coal Company, of Coshocton, O., first put in one of our machines, with our Standard 15 h. p. motor, but afterward exchanged the motor for a Junior, a lower and lighter one, because of the thin vein.

The rails of the track constitute one side of the circuit at this mine. The engine, generator and locomotive were furnished and installed by other parties.

In October, 1890, a plant of one 100-h. p. Buckeye engine, one 80 h. p. U. S. dynamo and three mining machines was installed at Prospect mines, East Palestine, O., in a 36-inch vein.

The table in the inspector's report gives the results of tests made on twe machines of other manufacturers in plants in Pennsylvania. As we are not represented outside of Ohio, in the table, we will mention the plants we have installed in other States:

The Sterling Mining Company, of Cannelton, Pa., has an 85-h. p. Taylor-Beck engine, an 80-h. p. U. S. dynamo and two mining machines. The Helvetia mines, of Helvetia, Pa., have two 100-h. p. Ball engines, two 80-h. p. U. S. dynamos, and four mining machines. The Redstone Oil, Coal and Coke Company, of Grindstone, Pa., has one 250-h. p. Cooper-Corliss engine, one 80-h. p. U. S. dynamo, and three mining machines. The Monongah Coal and Coke Company, of Monongah, W. Va., has two separate plants consisting of three Taylor-Beck engines, three 80-h. p. U. S. dynamos, and eight mining machines. The Thurmond Coal Company, of Thurmond, W. Va., has two 85-h. p. Taylor-Beck engines, two U. S. dynamos, 80 h. p. each, one 20-h. p. locomotive, and four mining machines. The Consumers' Coal Company, of Spillman, W. Va., has one 90-h. p. common slide valve engine, one 60-h. p. U. S. dynamo, and two mining machines. The Gardiner Mining Company, of Sidney, N. S., has one slide valve engine, one dynamo, made by the A. Robb and Sons' Company, of Amherst, N. S., and one of our mining machines. The Union Colliery Company, of Union, B. C., has a 100-h. p. Ideal engine, one 80-h. p. U. S. dynamo, and three mining machines. A plant is at present in process of construction for H. D. Turney & Co., of Congo, O.

In regard to the degree of satisfaction given by each of these plants, it is significant that those receiving the most intelligent care have given the best satisfaction financially, and therefore electrically and mechanically. The only electrical repairs required have been the truing up of the commutators, and in those mines having lathes the cost for this was very small.

We have found a disinclination on the part of mine operators to either allow a sufficient quantity of copper put into the line, for future requirements, when the plant is first laid out, or to sufficiently reinforce it when required because of the increase in distance from the dynamos, or in the number of machines working. We have frequently seen machines laboring along at a voltage of 32 per cent. below normal, at a plant that was properly constructed originally.

It is often stated that street railway work is the most severe of any, both on motors and generators. This is far from being the truth, except in a case of a small dynamo carrying but a few cars. The writer has observed the fluctuations of current in a great many different railway power houses, but never has he seen them so great as in mine work.

In regard to the motors, it is absolutely necessary that they be the lightest possible, and very low, the width and length also being quite limited. Experience with the compressed air engine on the same kind of a machine, long ago, showed us what power must be provided, which was a maximum of about 22 h. p. Extremely hard places will be encountered, even in what is supposed to be a very soft vein. A case in point: We equipped one mine with machines which were at the time said to be more powerful than necessary for that coal. This seemingly was proved after beginning work, as only 10 h. p. were consumed by each machine. This continued for a year, when, without warning, harder coal was struck, necessitating 20 h. p. at the machines. This lasted several months, and has not yet quite returned to its former state. At another mine the difference in power required by the machines in different entries is as high as 12 h. p.

As a rule, the men who run the machines have no consideration whatever for the motors. In order to prevent their being burned up, they must be so constructed that this is an impossibility in any coal that may ever be encountered. Fuses are no protection whatever, because if one blows, two are put in its place, and if necessary a half dozen; "they cannot be bothered with having to put in fuses."

"Why, if they are restricted to use of a certain size fuse, there are places where it will melt as fast as they can put it in, and as the coal *must* be cut, the only way is to put in enough to stand any current. If the motor burns up it is no good."

I know of two cases in which the man in charge run his machine nearly a month without any starting resistance whatever, something having gone wrong with the last coils, which cut the entire lot out. It may be asked why we do not teach these men better. The answer is, we thought we could at first, but in many instances they think they know more than we do.

Electric machinery for coal mines must be so made that it can stand anything, comparatively, in the way of hard work and abuse. These qualities and light weight are not consistent. Therefore, these things should be borne in mind when examining the table of tests.

As some of the results and comparisons therein are not so favorable to our machines as we think in justice they should be, we desire to point them out and give the facts as they are.

The horse power required to overcome frictional load, as given in the table, would lead one who did not know the facts in the case to believe that this was due to inferior design and poor workmanship. The truth is that the bearings of the machine soon become clogged with coal dust, which increases the friction to a very great extent. As an illustration of this I cite the following case:

A short time ago I instructed one of the machine runners who was at Prospect Mines, East Palestine, O., to take one of the machines out of the mine and give it a thorough cleaning and replace with new any parts that were badly worn, after which it was to be put to work again, and the current required to make a cut noted and compared with that used previously.

He improved upon our order, somewhat, by first making half a cut and noting the current, then cleaning the machine and returning it to the same place, finishing the cut already begun, and again taking a reading of the current. The result, as we expected, showed less power consumed, but our surprise was great when we learned the exact amount, which was *precisely one half* that used in the first part of the cut.

From tests made in the factory upon a new machine, which from newness will absorb more power in friction of bearings at such time than after it has been at work awhile (eliminating that due to coal dust), the loss was found to be 1 h. p. with the feed on.

We think we have made it obvious why there is such an apparent absence of efficiency in the machines. In regard to the high armature speeds given in the table, it must be stated that they were taken when the machine was running light. The motor is designed to run at 750 revolutions per minute at normal load, but as the field winding is simple series, and there is no regulating resistance, the armature naturally runs at a high speed when on light load. We no longer use the series fields, however, having adopted a shunt winding, which, while not having some of the desirable features of the series, gives a practically constant speed.

The Accumulator in Commercial Work.

BY J. STANFORD BROWN.

The accumulator as a factor in central station regulation has hardly received in this country the attention which it undoubtedly deserves, and as a consequence in this particular field our European brother electricians are ahead of us.

Several reasons for this state of affairs might be cited, chief of which perhaps has been the uncertainty hitherto prevailing with regard to patent rights and the somewhat exaggerated claims as to efficiency, durability, non-excessive discharge rate, etc., put forward by certain manufacturers.

In its application to the problem of electric traction, however, the secondary cell has been subject to more extensive and varied experiment here than abroad.

The storage battery, possibly more than any other piece of electrical apparatus in commercial use, demands *intelligent* supervision and management in order to get from it the best possible results, and yet there is prevalent a too general feeling of distrust in a secondary battery which is not wholly warranted unless they are unwisely expected to take care of themselves.

The number of modifications of the leading types, as to form of grid, is very large, and a study of the variations of no mean interest or importance.

Having had occasion in the course of business to look up a point with regard to the patentability of a certain variation of form, the following check list of references is presented to THE ELECTRICAL WORLD in the hope that it may save valuable time to some one having to hunt up the descriptions of any particular make of cell.

The list is, of course, far from complete, for having found out the required information the matter was for the moment laid aside.

American periodicals are given in small capitals and the English in capital letters, thus:

E. W. THE ELECTRICAL WORLD, New York.
E. E. *The Electrical Engineer*, "
E. R. " *Review*, "
E. A. " *Age*, "
E. P. *Electric Power*, "
W. E. *Western Electrician*, Chicago.
E. E. *Electrical Engineer*, London.
E. R. " *Review*, "
L. E. *The Electrician*, "

The abbreviations used for other periodicals explain themselves to those familiar with electrical literature.

ACCUMULATORS.—DESCRIPTIONS.

Alkaline, see Commelin, Elwell & Cie.
"Atlas," see Hering.
"Anglo-American," see Sorley.
Bailly ("Phœnix"), E. W. X., 7.
Bandsept.—E. E. XII., 427.
Barbier (vs. Woodward).—E. R. XXXIV., 106.
Barbour-Starkey.—L. E. XXV., 719; E. R. XXVI., 437; E. E. VI., 392.
Barker (ZnPb, peroxide).—E. W. XIV., 197.
"B. T. K.," see Beeman, &c.
Beeman, Taylor & King.—L. E. XII., 395; XIII., 118; XIV., 51, 499; E. W. VI., 7.
Blanc & Co.—E. E. IV., 99.
Bradbury & Stone.—E. E. VII., 433; E. W. XVIII., 98.
Brush.—E. E. III., 476; L. E. XII., 294; XXVI., 474.
"Cambridge," see Hatch.
Carpenter.—E. W. XIV., 276.
Cély (Sarcia).—E. W. XVIII., 385.
Commelin, Desmazures & Bailhache (Cu Zn alkaline).—E. W. XIV., 177; XVII., 19; E. E. III., 416; E. E. XII., 548; L. E. XX., 13; XXII., 302; XXVI., 195.
Correns.—E. E. XII., 497; E. W. XVIII., 251; L. E. XXVII., 592; E. R. XXV., 99; XXIX., 268.
Currie (lead chloride).—E. R. XXVII., 477; E. E. X., 375; XI., 72, 268.
Desmazures.—See Commelin.
Dey (experimental), E. E. XI., 162; L. E. XXVI., 506.
Dujardin.—E. E. VIII., 428.
Eickemeyer.—E. W. XIV., 304; L. E. XXIV., 135.
Electrical Acc. Co., N. Y.—E. W. XIV., 102; XVIII., 385.
Elwell & Cie (CuZn, alkaline).—E. W. XVIII., 385.
Elwell-Parker (+ Planté — Faure).—L. E. XI., 130; XII., 214, 255; XIV., 187; XV., 42; XVI., 212; XXII., 735.
"E. P. S."—See Electrical Power Storage Company.
Electrical Power Storage Co. ("E. P. S.").—E. E. VI., 313; VIII., 428; L. E. XIII., 320; XIX., 209; XXI., 90; XXII., 735; XXVI., 5; E. W. XVIII., 385.
Entz.—See Waddell.
Epstein.—E. E. VII., 480.
Ernst.—E. E. XI., 158.
Farbaky & Schenck.—E. W. VIII., 62; L. E. XVII., 190.
Faure (1880).—E. W. VI., 7; E. E. VIII., 409; L. E. XXI., 218.
Faure-Sellon-Volckmar.—L. E. XII., 306; XIII., 59, 435; E. R. XXV., 469; E. W. XVIII., 388.
F. S. V.-Gadot.—L. E. XIII., 290.
Fitzgerald (Lithanode).—E. W. VII., 198; L. E. XXVII., 691; E. R. XXIX., 310.
Gadot.—L. E. XIV., 142; XXI., 605; E. W. XVIII., 385.
Garassino.—E. W. XVIII., 385.
Gaudini.—E. R. XXIX., 323.
Gibson.—E. R. XXIV., 23; XXVIII., 438; L. E. XXI., 103.
Glaesener.—L. E. XV., 200.
Hagen.—E. W. XVIII., 251, 385; E. E. VI., 566.
"Hair."—L. E. XVIII., 153.
Hatch ("Cambridge").—E. E. XI., 184; E. W. XVII., 2, 46.
Hedges.—L. E. XIX., 485.
Hering.—E. E. IX., 447; E. W. XV., 403, E. E. VI., 9.
Hering, Abdank-Abakanowicz, d'Arsonval & Picon.—E. E. XI., 299; L. E. XXVI., 484; E. R. XXVIII., 207.
Hollingshead.—E. E. X., 256.
Howell.—L. E. XX., 695, 727, 751.
Huber.—E. W. XVIII., 385.
James.—L. E. XXVI., 751.
Jarman.—E. E. X., 470; E. R. XXVIII., 224; XXIX., 46.
Johnson.—E. R. XXVII., 446.
Julien.—E. W. IX., 240; XVIII., 252, 385; L. E. XX., 192.
Kabath.—L. E. IX., 61; XI., 436.
Kalisher.—L. E. XV., 41.
De Khotinsky.—E. E. XII., 534; E. W. XVIII., 252; 385.
Kirchhoff (1861).—L. E. XVII., 111; E. W. VII., 257, 260.
Knowles-Julien.—E. W. XIII., 160; XIV. 34.
" " (anticipated by Sellon).—L. E. XXIII., 388.
Lalande & Chaperon.—(CuZn, alkaline).—E. W. XVIII., 385.
Laurent-Cely.—E. E. IX., 477; E. R. XXVII., 277; L. E. XXI., 320; XXV., 82, 108.
"Lithanode."—See Fitzgerald.
Lloyd & Paxton.—St. Ry. Jrl. VII., 349.
Logan.—E. W. XIV., 426.
Lugo.—E. E. XII., 261; E. E. III., 106.
Macraeon (Planté—Faure).—Sci. XIII., 195.
Main (ZnPl, "River and Rail").—E. E. X., 132; XII., 548; E. W. XVI., 54.
Marx (Fe).—E. E. IX., 363, 435; E. E. VIII., 124.

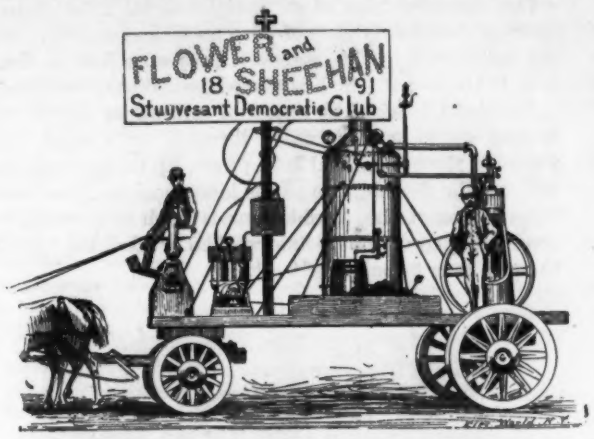
McLaughlin.—E. W. XVI., 249, 289.
Meserole (Zn).—E. E. XII., 548; E. W. X., 16.
"New Era."—E. W. XVIII., 195.
Niblett (solid).—E. E. VIII., 80.
"Oerlikon."—See Schoop.
Parod.—L. E. XIV., 175; E. W. V., 49.
Payer ($PbCl_2$).—E. W. XIV., 368.
Phillips.—See Waddell.
"Phœnix."—See Bailly.
Planté (1860).—E. W. V., 49; VI., 7; VII., 257; XIII., 192; XVIII., 385; L. E. XII., 255; E. R. XXVII., 716.
Pollack.—E. E. VIII., 428; IX., 309; XII., 534; E. W. XVIII., 252, 385; E. R. XXVI., 377.
Pumpelly.—E. W. XIV., 426.
Reynier (Zn).—E. W. XII., 548; L. E. XIV., 303; XXV., 186; XXVI., 113; E. E. X., 666; E. W. VIII., 102; X., 102; XVI., 440; XVII., 206.
Schoop ("Oerlikon," gelatine).—E. E. VIII., 428; XII., 534; E. W. XIV., 33; XVIII., 252, 385; L. E. XXIII., 187; XXV. 245, 253.
Sellon.—See Faure-Sellon-Volckmar.
Slattery.—El. Ry. Advr., II., 45.
Smith-Cornelius.—L. E. XIX., 216.
S. A. p. l. T. E. d. M.—E. E. VIII., 428.
Sorley ("Anglo-American").—E. W. XIV., 50, 140.
Starkey.—See Barbour-Starkey.
Starr (Planté).—L. E. XIV., 29.
Tatham.—E. E. III., 132; E. W. XIII., 158.
Tamine.—E. W. X., 76.
Tommasi (Multitubular).—E. R. XXIX. 497; E. E. X., 671; XII., 555; Elec. Ent. II., 382; L. E. XXVII., 681.
" (anticipates Woodward)., L. E. XXVI., 130, 182.
Tudor (Planté).—E. E. XII., 497; E. W. XVIII., 251, 385; L. E. XXI., 165, 180, 490; XXVII., 592; E. R. XXIX., 268.
Van Gastel.—E. W. IX., 191; L. E. XXIII., 536.
Waddell-Entz—Phillips (Cu oxide, alkaline).—E. E. X., 537; E. W. XV., 190; XVII., 354; XVIII., 385; L. E. XXVII., 647; E. R. XXVIII., 675.
Washburn.—E. E. XI., 546.
Winkler.—E. E. XII., 108.
Woodward.—E. W. XIII., 177; E. E. VII., 82.
" (anticipated by Tommasi).—L. E. XXVI., 130, 182.

Illuminated Campaign Banner.

A feature of one of the large political parades in this city, during the recent gubernatorial contest, was a complete electric light plant mounted on a truck, the object being to obtain an illuminated sign bearing the names of the Democratic candidates, Flower and Sheehan.

A small boiler and engine were fastened to the floor of a large truck, and a 12 kilowatt Edison dynamo placed near the driver. An upright stanchion bearing the inscription was then screwed to the floor, and the electrical connections made. The principal feature of these was the commutating switch whereby the sign could be lighted by letter successively or the entire number at once. The banner was 14 feet long, and 5½ feet wide, and contained 221 16-c. p. lamps. The light effect was very attractive. The necessary openings for the lamps were cut in, making a perforated mass of sheet iron. Behind this a set of reflectors were arranged on a back board to which the incandescent lamps that formed the principal names were attached. Thus the front board acted as an intensifier of the white light from the lamps as their rays shone through.

The night of the parade in which this novel banner took part was very rainy, but the intrepid electric lights burned for four continuous hours with no protection from the downpour, and not a light went out or single mishap occurred. It created intense enthusiasm everywhere, and its builders congratulate themselves that it was on the winning side.

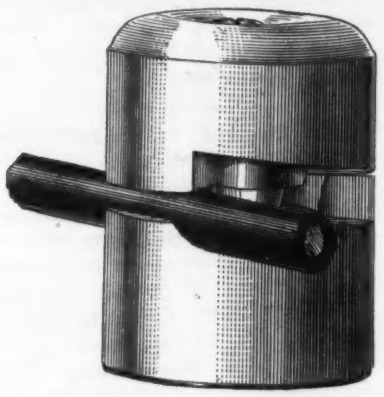


A TEMPORARY PLANT FOR POLITICAL PURPOSES.

As the electric light is now used for a great variety of temporary purposes, an opportunity is often afforded for a construction company to make a reputation for itself by doing rapid and thorough work, and placing a complete plant in operation at only a few hours' notice.

The New Security Insulator.

The accompanying illustration shows what has been termed the "New Security Insulator," which is about to be placed on the market by the Security Insulator Company,



THE SECURITY INSULATOR.

of 136 Liberty street, New York City. Many points of superiority are claimed for it, among which may be mentioned the fact that it is easily and quickly adjusted to the insulation, the wire being pressed into a groove by a cap, and this cap by means of a cam movement is made to grasp and hold the wire securely. It will be seen that the arrangement obviates entirely the use of tie wires, thus effecting a large saving of time and labor in wiring. With the size of insulator shown in the cut wire one-eighth to three-eighths of an inch may be used, allowing a variation of one-quarter of an inch in the size of the wire. The insulator is made of the best vitrified and non-absorbent porcelain.

The Gill Water Tube Boiler.

The permanent form which the water tube boiler has now assumed is remarkable for its simplicity. It consists of a bank of tubes usually four inches in diameter, and from 12 to 18 feet in length, surmounted by a horizontal water and steam separating drum, from 30 to 50 inches in diameter and about the same length as the tubes. The tubes are expanded into boxes or headers at each end and these headers are connected with the drum overhead, by circulating tubes or other connections.

When in use, the tubes, headers and connections are filled, and the drum one-half filled with water. The water level is carried about the middle of the drum, which on account of its comparatively large diameter offers a large evaporating surface. This large surface is absolutely necessary for the production of dry steam, the furnace being placed under the bank of tubes. The flame circulates around the tubes, being properly guided by suitable passages so as to cause it to give up as much of its heat as possible before it escapes into the chimney.

The Gill boiler, shown in Figs. 1 and 2 on this page, is of this class. It has been carefully designed, embodying all the best features of its kind.

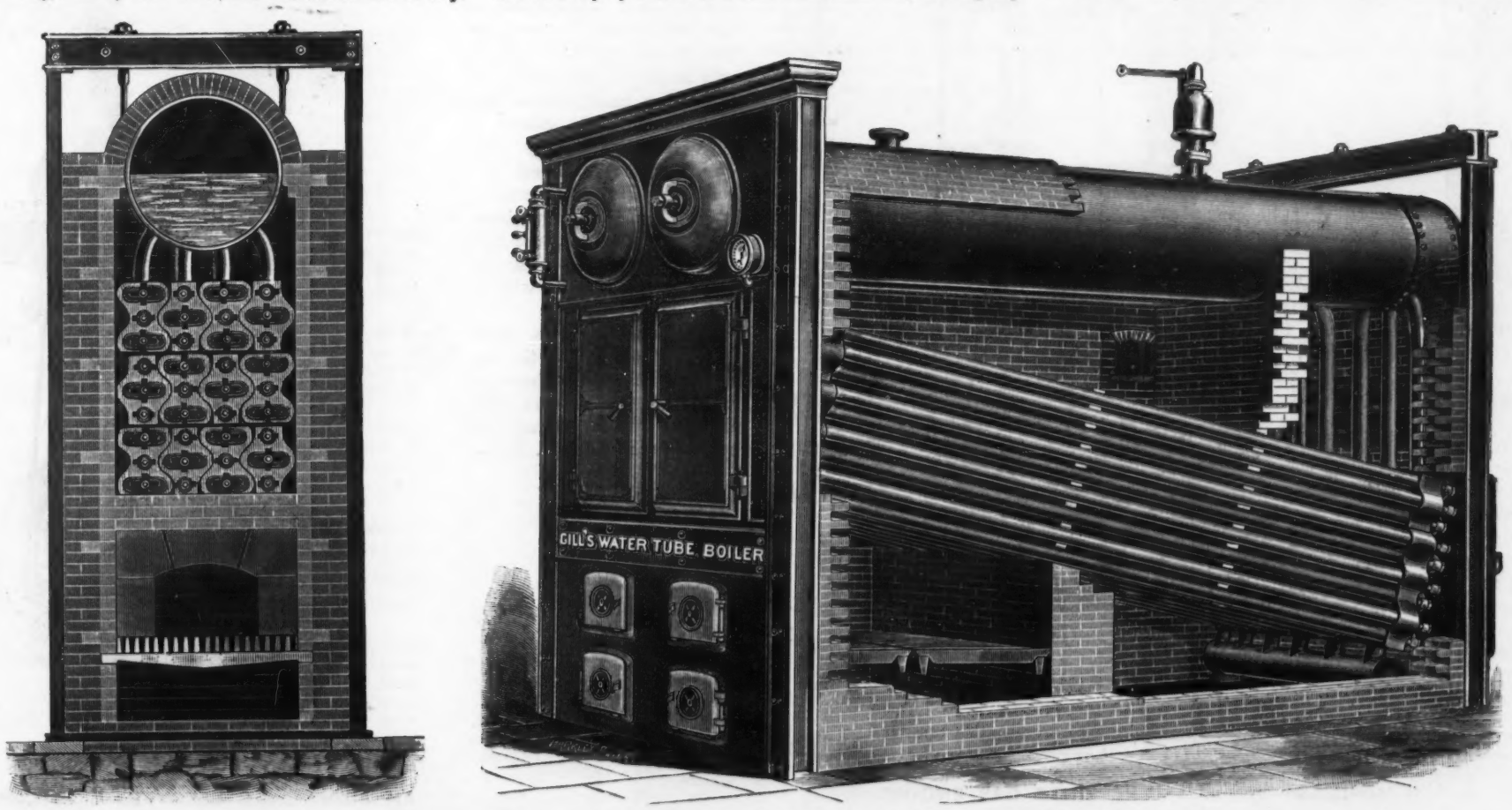
The boiler, as will be seen, provides for perfect distribution of the gases. Liberal proportions of heating surface are given and furnaces are adapted to the fuel to be used in any given case.

The Sintz Gas Engine.

We give in this issue in an illustration a detail diagram of the Sintz gas engine, which is manufactured in various sizes for both stationary and marine purposes. The mechanical construction of this engine seems to be in accordance with the best principles of engineering, the design and arrangements of the parts being such that no unusual strains are brought to bear which will produce a tendency to wear out of line, all wearing surfaces being made amply large and of such material as to stand the work without frequent adjustment or renewals being necessary.

The details of the operations of this engine are as follows: It is so constructed that it makes its own gas from a small quantity of gasoline as fast and no faster than it is used, it is entirely independent of previously manufactured gas, and is adapted for use in towns or in the country where gas cannot be obtained.

A small force pump for gasoline is attached to the base of the engine, and is operated by a cam on the centre shaft. The supply tank is placed on the outside of the building, and a small pipe (¼ in.) leads to the suction side of the pump. A very small base discharge pipe leads to and discharges into the air pipe near the inlet or air valve of the engine. The throw of this pump is controlled by a governor so that when the engine is working at maximum power the gasoline pump begins its down stroke and when the main or power piston has made one-fourth of its down charging stroke, the pump finishes its stroke when the power piston has made seven-eighths of its charging stroke, causing all the gasoline to pass into the combustion chamber. The return stroke compresses the charge and it is exploded, at a point (determined by the indicator) just before the crank reaches the upper centre, so as to give full pressure when the crank is on the centre. When the engine is running light the charge is made to suit the work being done. Thus

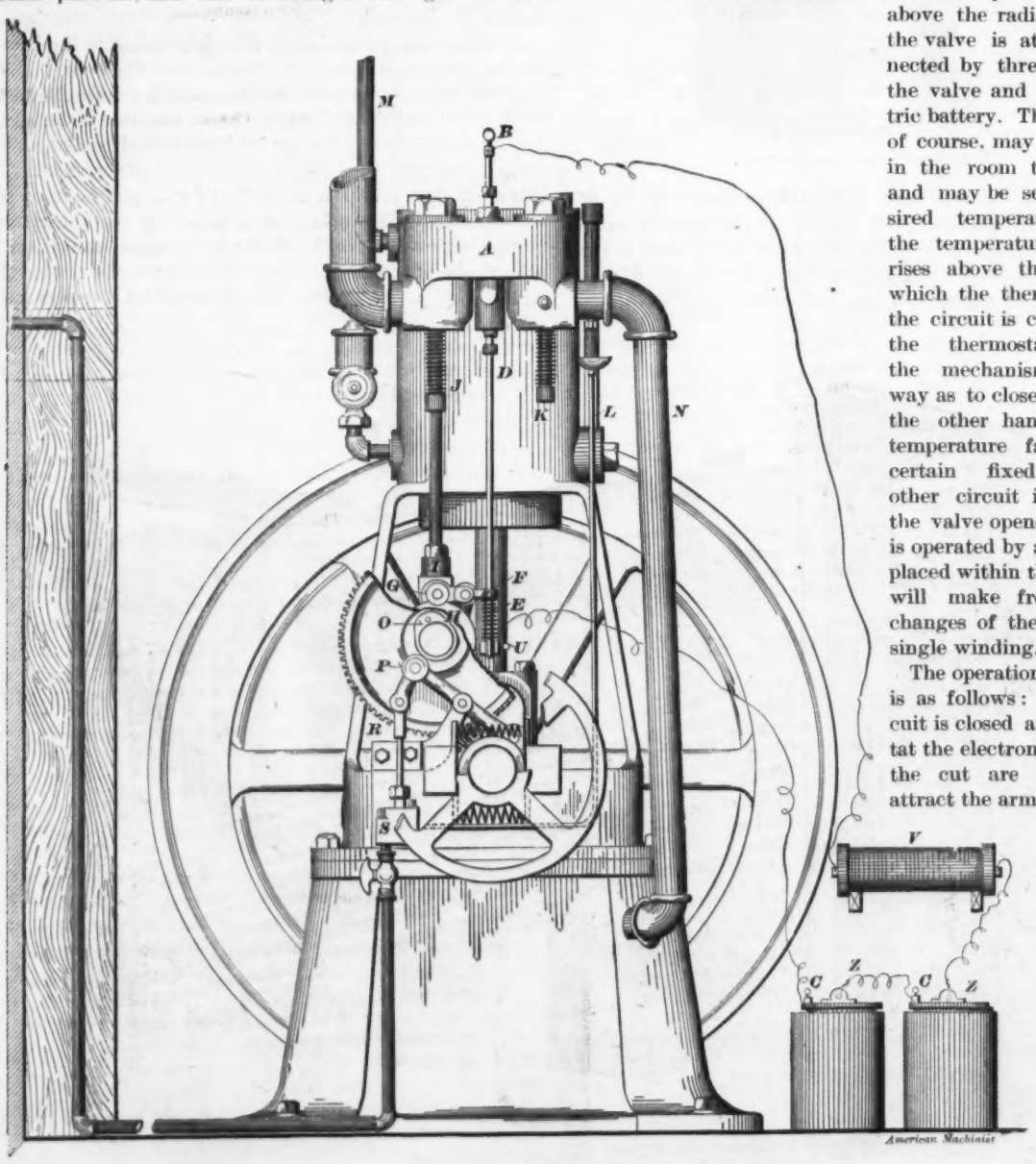


FIGS. 1 AND 2.—TWO VIEWS OF THE GILL WATER TUBE BOILER.

if it requires one-fourth of a charge, the governor allows the power piston to descend and take air for five-eighths of the stroke, and then the gasoline pump begins its stroke, but finishes at the same point as when giving a full charge, making its action the same as that of the automatic steam engine. The charge is so placed in relation to the exploder as to always insure being ignited. This engine is strictly of the "automatic cut-off type," and its features are economy and regularity. An important feature of the

PORTABLE LAMP STAND.

Sintz engine is the fact that it never requires cleaning inside. Many of these engines have been run with Northwestern Ohio natural gas, which is full of sulphur and very hard on an engine, for the past eighteen months without the least trouble, it is stated, and with no cleaning inside. It consumes but 15 cubic feet of gas, either manufactured or natural, per horse power per hour, and the automatic action of the engine is the same when using any kind of gas as when using gasoline. It can be run by the coal, water or natural gas used in Northwestern Ohio, Indiana, New York, and California, and also with petroleum fuel gas that is 97 per cent. pure air, and can be changed from gasoline to the



THE SINTZ GAS ENGINE.

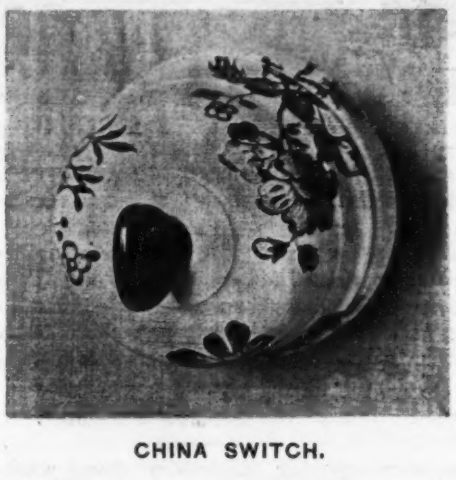
above very easily, only one small piece requiring to be changed. These engines are manufactured by Clark Sintz, of Springfield, O.

The New "C. S." Portable Lamp Stand.

The accompanying cut illustrates a portable lamp stand with adjustable arm, now being put upon the market by the Cutter Electrical and Manufacturing Company, 27 South Eleventh street, Philadelphia. The cut represents the stand, mounted and wired, to which is attached a combination reflector shade.

The stand consists of an upright metal tube mounted upon an ornamental base of spun metal and marble. From the upper end of this standard projects a hollow flexible arm, to the end of which is affixed the ordinary lamp socket.

The stand is wired by means of a fireproof flexible cord, which, entering the fixture through an ebonite sleeve placed in the ornamental base, passes up through the standard and the flexible arm to the lamp socket. The interior construction of the flexible arm is such as to protect the conducting cord from being crushed or abraded, however the arm may be coiled or bent.



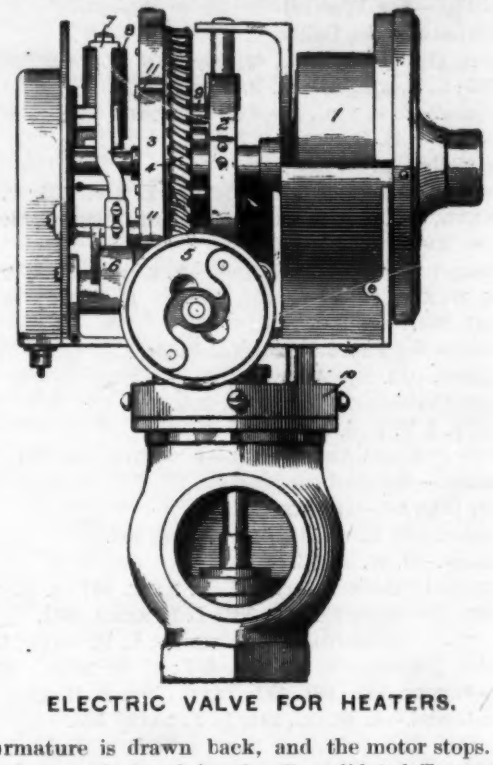
CHINA SWITCH.

This flexibility of the arm enables the user not only to concentrate his light upon any desired point at will, but it permits him in so doing to form the arm into almost any graceful curve that may be suggested. This flexible arm is also modified into a wall bracket which may be curved or coiled into any desired form.

An Automatic Electric Valve for Steam Heating Systems.

This valve is shown in the accompanying illustration with its cover removed. A thermostat placed on the wall above the radiator to which the valve is attached is connected by three wires with the valve and with an electric battery. The thermostat, of course, may be anywhere in the room to be heated, and may be set for any desired temperature. When the temperature of the room rises above the degree for which the thermostat is set, the circuit is closed through the thermostat operating the mechanism in such a way as to close the valve; on the other hand, when the temperature falls below a certain fixed point the other circuit is closed and the valve opened. The valve is operated by a heavy spring placed within the drum, and will make from 65 to 75 changes of the valve with a single winding.

The operation of the valve is as follows: When the circuit is closed at the thermostat the electromagnets at 8 in the cut are energized and attract the armature 7. As the armature is drawn down a hook which holds the stop 6 in position when the machine is at rest is drawn back and the stop is pushed away by the power of the spring 1 communicated through the shaft to the wheel 3. As the motor starts one of the rollers, 9, strikes the headpiece 2, which is clamped to the stem of the valve, and if the valve is being closed the roller forces the valve disc down to its seat and locks it so that it cannot open until the motor starts again. When the valve is nearly closed, the roller engages a flat spring fastened in the lower end of the headpiece which requires a push of 30 pounds to compress it. As the roller compresses the spring, the valve is forced down on its seat and all lost motion is taken up. In opening, one of the rollers strikes the upper end of the headpiece and raises the valve. As soon as the circuit is broken



ELECTRIC VALVE FOR HEATERS.

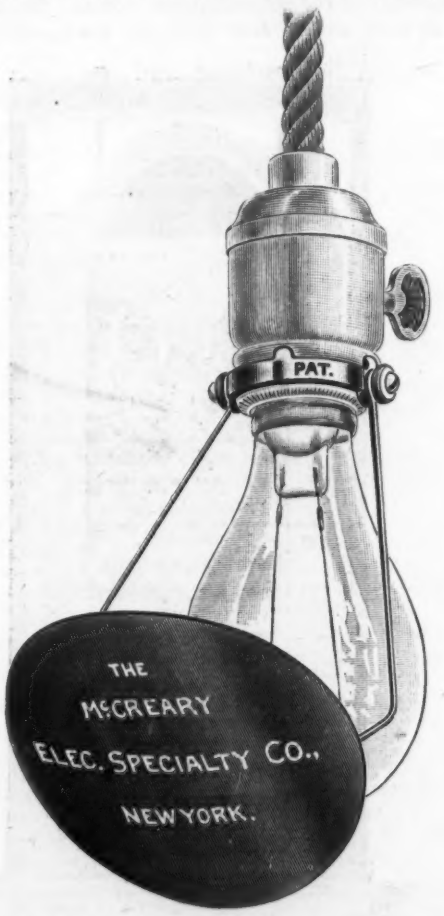
the armature is drawn back, and the motor stops. The valve is manufactured by the Consolidated Temperature Controlling Company.

Electrix China Switch.

We illustrate herewith a new china decorated switch which is being introduced by the Star Electrix Company, of Philadelphia, and which will doubtless become very popular among architects and in every place where a finely finished and highly artistic article is required. These switches are finished in plain ivory color, in jet and in all tints desired, both in the single pole and the three-point types.

An Adjustable Electric Light Shield.

The McCreary Electrical Specialty Company, always on the alert to procure the best appliances for protecting the eyes from the incandescent electric lamp, has just secured the exclusive control of a very useful invention shown in the accompanying illustrations, which is to be called the adjustable electric light shield. It is fitted with a spring clamp which can be attached to any socket,



AN ADJUSTABLE ELECTRIC LIGHT SHIELD.

the shield can be moved to any place along the wire, and the wire holding the shield will remain in any position either above or below the lamp. It takes the place of all kinds of shades which are now tied over the eyes. It being intended to only shield the eyes and not to obstruct the light or work of any kind, it will be found invaluable to bookkeepers, printers, silversmiths and workmen in factories and mills of every description.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

Westinghouse Finances.—The Boston *News Bureau* says: "People close to the management of the Westinghouse Electric Company say that the company's floating debt is now practically paid off."

Bell Telephone Output.—The statement of the Bell Telephone output for Oct. 21 to Nov. 20 is as follows:

	1891.	1890.	Inc.	Dec.
Gross output	5,767	5,318	449	
Net output	2,100	2,926	....	826
Dec. 21 to Nov. 20:				
Net output	25,747	34,398	....	8,651
Instruments in use Nov. 20	507,377	478,139	29,238	....

The net output of instruments for the past six months compares as follows:

	1891.	1890.	Dec.
November	2,100	2,926	826
October	1,048	3,173	2,125
September	1,911	3,365	1,454
August	1,464	1,561	97
July	61	1,900	1,839
June	5,544	5,831	287
Total	12,128	18,756	6,628

The Closing Quotations of electric stocks on Saturday, Nov. 28, 1891, in New York and Boston were:

Name of Stock.	Par.	Capitalization.	Bid.	Ask'd.
Western Union Telegraph Co	100	86,200,000	....	82⅛
American Telegraph & Cable	100	14,000,000	....	....
Central and South American	100	5,000,000	....	....
Mexican	100	2,000,000	....	....
Commercial Cable Co	100	7,716,000	....	....
Postal Telegraph Cable	100	5,000,000	....	....
Edison General Electric	100	15,000,000	....	93½
Consolidated Electric Light	100	2,500,000	20	30
Edison Illuminating Co., New York	100	4,500,000	80	81
" " " Brooklyn	100	750,000	75	78
" " " Boston	100	1,263,500	97½	102½
" " " Chicago	100	750,000	135	145
U. S. Illuminating Co	100	1,250,000	30	35
North American Phonograph Co	....	....	2	4
New York Phonograph Co	100	6,200,000	2¼	4
Edison Elec. Light Co. (of Europe) stock.	100	2,000,000	2½	5
" " " " bonds	..	30,000	65	75
" Ore Milling Co	100	2,000,000	17½	22½
" Toy Phonograph Mfg. Co	10	1,000,000	½	1
U. S. Electric Light Co	100	1,500,000	....	20
Brush Illuminating Co., of New York	50	1,000,000	40	50
Mt. Morris Electric Light Co	....	500,000	....	60
East River Electric Light Co	100	1,000,000	....	60
Thomson-Houston Electric Co	25	6,000,000	47⅝	48
" " preferred	25	4,000,000	26	26½
" International Electric Co	100	1,000,000	....	200
Thomson Electric Welding Co	100	1,000,000	....	....
" European Electric Welding Co	100	1,500,000	20	25
Westinghouse Electric Co., assented	50	7,000,000	....	13
Fort Wayne Electric Co	25	4,000,000	12	12¾

Chicago Quotations.—Col. S. G. Lynch, broker, 153 Monroe street, Chicago, furnishes quotations on electrical stocks as follows:

TELEPHONE STOCKS.

Chicago	$212@ $220	Cumberland	$60@ $62
Central Union	51@ 52	Wisconsin	118@ 120
Michigan	81@ 83	Bell of Missouri	175@ 180
Great Southern	30@ 32	Iowa Union	20@ 22
Colorado	34@ 36	Missouri and Kansas	54@ 56
Rocky Mountain Bell.	40@ 43		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$95@ $97	Chicago Edison Co	$139@$140

NEW INCORPORATIONS.

Victoria, Texas.—The plant of the Victoria Light, Power and Ice Company has been leased to N. T. Gaines. The capacity of the plant will be doubled.

The Paragould Electric Light and Power Company, of Paragould, Ark., with a capital stock of $6,000, has been organized to manufacture and furnish electric lights, electric power, etc. C. Wall, W. C. McDonald, M. F. Callier and A. Bertig are the promoters.

The Velasco Ice, Light and Refrigerator Company, of Velasco, Tex., with a capital stock of $50,000, has been organized to manufacture and operate an electric light plant, etc. The incorporators are H. Hamilton, J. A. Patton, H. Prince and C. A. Zilker, of Houston, Tex.

The Cleveland Electric Lighting Company, of Cleveland, O., has been incorporated, with a capital stock of $100,000, to manufacture electricity and furnish electric light, heat and power. A. L. Bassett, C. E. Shattuck, Chas. H. Gill, R. A. Carran and H. C. Bunts are the organizers.

The Mechanicsville Light, Heat and Power Company, of Mechanicsville, N. Y., with a capital stock of $25,000, has been organized to manufacture, use and supply electricity for light, heat and power. The promoters are Cornelius R. Sheffer, Stephen Lee and Jos. H. Packer, all of Mechanicsville.

The Farmers' Protective Union, of Bradley, Cal., with a capital stock of $50,000, has been incorporated to construct and operate gas and electric works. J. A. Haskett, J. T. Donaldson, T. Bowen, D. Manning, F. Cochran, E. Bergeman, J. W. Jones, H. C. McDonough and J. J. Betts are the organizers.

The Des Moines Water Power and Electric Company, of Des Moines, Ia., capital stock $225,000, has been incorporated; its object is to purchase the Des Moines water power plant, and to establish and maintain an electric plant therewith. L. W. Goods, Fred. D. Goods and C. E. Meade, all of Des Moines, are the organizers.

The Ouray & Ironton Electric Railway, Light and Power Company, of Ouray, Colo., capital stock $800,000, has been formed to build a railroad from the town of Ouray to Poughkeepsie Gulch, thence to the town of Ironton. Otto Mears, Fred Walson, Chas. Munn, J. N. Casanova and Wm. A. Wallace are the incorporators.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, NOV. 30, 1891.

Mr. E. E. Winters, of Schenectady, N. Y., called at the office of THE ELECTRICAL WORLD last week.

The McCreary Electrical Specialty Company, of 136 Liberty street, New York, as will be remembered by a large number of the favored ones, distributed last year a handsome glass paperweight containing a calendar. A new set of the calendars are now ready, and those owning the original paper-weight can obtain same on application.

Mr. Walter G. Chase, the general manager of the Mason Regulator Company, Boston, while in New York during the past week, remarked that his company was unusually busy and orders were rolling in by every mail. Mr. Chase is a firm believer in printers' ink, and his unique advertisements grace all the principal trade journals throughout the country.

Mr. Will C. Turner, formerly secretary and manager of the Columbus (Ohio) Edison Company, has opened an office in Room 6, 120 Broadway, New York, for negotiating the sale of electric light, street railway, gas, water-works, state, municipal and corporation bonds. There is a demand for just such a bureau, especially as investors are not as yet well enough acquainted with the great value of a great many of the electric light and railway stocks offered. Mr. Turner ought to do well.

The Nassau Electrical Company, of 112 White street, New York, have recently made some important improvements in their "capsule" battery. One of the most noticeable is the drawing of solid zinc into a cylindrical case. Heretofore we believe nothing of this sort has been accomplished. Workers in brass have been able to do this, but in zinc there were many problems to overcome. The Nassau company is doing a nice business and reports constantly increased demand for its specialties.

Mr. H. Ward Leonard is making arrangements to apply on a considerable scale his transmission of power devices, of which something was said in our last issue. He has now received his patents, and they contain a number of strong and sweeping claims on the general method employed, which consists in the rough of doing work by supplying electromotive force proportional to the desired speed and current proportional to the desired torque. There are a number of ingenious modifications descri bed inthe patents, among them several for combinations between alternating and direct currents for electric railway and other use.

Mr. Willard W. Low, president of the Electric Appliance Company, of Chicago, made us a pleasant call on Tuesday of last week. Mr. Low has been in the East for two weeks, completing arrangements so that when his company open actively for business Dec. 1 they will have a most complete line of the latest novelties in electric light, street railway and other electrical appliances. They will introduce a new insulated wire to the trade that is now being prepared for the market in large quantities. As Mr. Low is one of the oldest salesmen in the Western territory, his friends being legion, there is good reason to believe that the new company will receive at once a fair share of the orders now being given out.

Mr. W. H. Eckert has accepted the general agency of A. G. Day & Co., manufacturer of Day's Kerite insulation, vice George B. Prescott, Jr., retired. Mr. Eckert is one of the "old-timers" in the electrical industry, and is said to have been the first to have received a telegraphic message by sound. Starting as a messenger boy, he worked his way up through the different departments of the Western Union Telegraph Company until the telephone became such an important factor, when he, believing in its great future, joined fortunes with its early promotors. It is related that Mr. Eckert came to New York at one time and offered the Cincinnati Telephone Exchange, with all its rights and privileges, for sale at $125,000 with no takers, a year afterward $1,000,000 was refused for the same. This shows the remarkable growth of that particular branch and Mr. Eckert's successful administration. He afterward came to New York and was for some time general superintendent of the Metropolitan Telephone and Telegraph Company; of late he has been interested in various electrical inventions. Mr. Eckert's office will be at 16 Dey street, this city, where he will be glad to see all of his old friends.

The New York Electric Club.—A lecture will be delivered at the club house, No. 17 East Twenty-second street, on Thursday, Dec. 3, at 8 P. M., by Mr. E. Rosewater, editor of the *Omaha Bee*, and president of the Old Time Telegraphers' Association, on "The Government Telegraphs of Europe." Mr. Rosewater, under commission from the Hon. John Wanamaker, Postmaster-General, has recently made a very thorough investigation of the various European systems of government telegraph, and comes before the club with date, facts and arguments never before presented. He is himself an advocate of government control of telegraphs and telephones in America, and his opinions are the more important for the reason that he is an old and experienced telegrapher. Mr. Rosewater's lecture will embrace a number of details, including administrative features, methods of operation, figures of the work, tenure of office by the employés, rates of salary, relations between the government and the press, etc. Several well known public men have expressed a desire to be present and participate in the discussion. The evening will be one of the most interesting and enjoyable in the history of the club. The lecture will begin punctually at the hour named.

L. H. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 28, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., Nov. 28, 1891.

Mr. Stephen E. Barton, president of the Electric Mutual Insurance Company, has been nominated as one of the Advisory Council of the Insurance Congress of the World's Fair. On this council will be fifteen representatives of stock insurance companies, six of mutual companies, three of marine companies, four managers of English companies, two managers of Canadian companies, and seven representatives of the large insurance organizations. Mr. Barton will represent the Electric Mutual Company.

Electric Soldering.—An incident occurred during the construction of the Columbia Theatre, Boston, which demonstrated the convenience and value of the electric current for soldering irons. The ceiling work called for a large amount of soldering work, and owing to its height and inaccessibility the regular plumbers' furnaces could not be used except with great danger. In this emergency the electric irons of the Butterfield-Mitchell Electric Heating Company were called into service. The current was obtained through a flexible wire from the regular lamp sockets, and the work was completed just in the nick of time.

A New Electrical Society.—A number of gentlemen interested in electrical science have, for the general purpose of increasing their knowledge in that subject, lately organized an electrical society in Middletown, Conn., and called it the "Middletown Electrical Society." They met in the parlors of Chafee's Hotel, and elected the following officers for a term of six months: M. Loewenthal, president; H. E. Bradley, vice-president; J. W. Garside, recording secretary; D. O'Donovan, corresponding secretary; J. C. Sanders, treasurer; F. H. Watson, editor, and H. E. Bradley, A. E. Andrews and G. D. Foote, executive committee. The object of this young but promising organization is "the mutual advancement of its members in electrical science." Papers will be read on elementary and advanced subjects by the members, most of which will be illustrated by experiments. At their last meeting the president delivered his inaugural address, in which he clearly set before the members the advantages which may be derived from this society.

C. A. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
465 THE ROOKERY, CHICAGO, Nov. 28, 1891.

Mr. A. K. Stiles returned to Chicago this week from Bessemer, Ala.

Mr. D. R. Russell, of the Parker-Russell Company, St. Louis, was a welcome visitor in Chicago this week.

Mr. F. H. Pond, of the Pond Engineering Company, St. Louis, was one of the visitors in Chicago this week.

Mr. J. B. Crouse, president of the Standard Carbon Company, Cleveland, O., is writing some nice orders in Chicago this week.

Mr. W. J. Pilley, of the Eastern Electrical Supply Company, Boston, left Chicago on Tuesday on a flying trip to New England.

Mr. H. K. Gilman, president of the Great Western Electric Supply Company, Chicago, is receiving numerous congratulations on the arrival of a very handsome little girl.

Mr. J. H. Rhotehamel, president of the Columbia Incandescent Lamp Company, St. Louis, secured some nice orders during a personal visit to Detroit this week, and while stopping over in Chicago obtained orders for several thousand Columbia lamps. Mr. Rhotehamel has appointed the Great Western Electric Supply Company to act as Chicago agent.

Mr. John I. Beggs, district manager of the Edison General Electric Company for the central district, with headquarters in Chicago, was the recipient of a thousand-dollar diamond ring as a Thanksgiving offering from his numerous employés. The presentation occurred at the close of a prosperous fiscal year, a day or two before Thanksgiving, and was so well managed as to be a complete surprise to Mr. Beggs.

The Chicago Electric Club enjoyed a pleasant entertainment on Monday evening, when Mr. C. C. Haskins read a bright, witty paper touching up the methods pursued by an imaginary manufacturer of insulated wires in calling attention to the virtues of his goods. This was followed by a mock trial, in which Mr. W. J. Buckley distinguished himself by the ability shown in prosecuting the offender, while Mr. C. E. Gregory created unbounded laughter as the clerk of the court, and Mr. F. E. Degenhart was a success as the attorney for the accused. The attendance was large, and the trial was followed by an informal lunch.

F. DE L.

OMAHA, Nov. 27, 1891.

The Burlington (Iowa) Electric Railway is experimenting with an electric heating apparatus for cars.

The Karbach Block has been wired for 700 16-c. p. 50-volt lamps by John Burke. Okonite wire has been used throughout.

A New Dynamo Added.—The new Omaha Thomson-Houston Electric Company has recently purchased a 1,300-light Thomson-Houston alternator to take care of its increasing business.

The Sweezy Hotel has been opened under the name of "The Brunswick," and is using electric lights exclusively. There being over 400 16-c. p. in circuit. Bishop rubber covered wire is used.

The Mercer Block has just been completed, and is lighted up from the Thomson-Houston Electric Company's plant with 500 16-c. p. incandescent lights. The wiring throughout is of the Okonite brand.

New Railway.—A number of prominent business men in Omaha, among them Messrs. Cudahy, Paxton and others, are endeavoring to get a franchise for a new electric street railway. The company is to be called the Metropolitan Street Railway Company.

The Western Electric Company, of Omaha, under the excellent management of Mr. Sharp, reports the following sales of Okonite wire: City Hall, Omaha, for 1,000 lights; Dr. Mercer block, for 500 lights; Karbach block, for 700 lights. An increasing demand for Bryant sockets is also reported.

The Shenandoah (Iowa) Electric Light Company is about ready to turn on the lights. There has been a great deal of good-natured rivalry between the Shenandoah Electric Light Company and the Red Oak Electric Light Company as to which would start its plant first. Present indications give Shenandoah a trifle the start.

LINCOLN, Neb., Nov. 27, 1891.

Mr. Shephard, the electrician for the Lincoln (Neb.) Street Railway, has "taken unto himself" a bride. The gentleman has the good wishes of his many friends.

Theatrical Lighting.—The lights were turned on for the first time last evening at the new Lansing Opera House. To say they were a complete success is putting it mildly. The Lincoln Supply Company installed the work. The lamps, 1,134 in number, were furnished by the Lincoln Manufacturing Company, of which Mr. Campbell is the manager.

Contracts Awarded.—The contract for the Episcopal College, Lincoln, Neb., has been awarded to the Biglow Supply Company, and work will be commenced at once. The contract for lighting the extensions to the State Insane Asylum at Hastings, Neb., has been awarded to the Lincoln Electric Manufacturing and Supply Company. There will be 400 lights of 16 c. p. each. Habirshaw wire will be used.

SOUTHERN NOTES.

NORFOLK, Va., Nov. 28, 1891.

Sutherland, Fla.—An electric light plant is contemplated.

Madison, Ga.—An electric light plant is now being installed.

Sutherland, Fla.—An electrical railroad is in contemplation.

Macon, Ga.—The city is to be well supplied with the Gamewell police telegraph system.

Franklin, Ga.—A telephone line is being rapidly strung between Franklin, Corinth and Hogansville.

Moundsville, W. Va.—An electric light plant will be put in the factory of the Fostoria Glass Company.

Newport News, Va.—Work on the electric road between Newport News and Hampton will begin at once.

Athens, Ga.—This town is said to have the best system of electric lights of any city in the State of Georgia.

New Castle, Va.—The Craig City Inn, recently opened, has been fitted up with electric lights and electric bells.

Lenoir, Tenn.—Contract has been let for putting an electric light plant in the flour mill of Dempster & Plummer.

Victoria, Tex.—A new dynamo and increased capacity will be added to the Victoria Light, Power and Ice Company.

Calvert, Tex.—An electric light plant will be put in the works of the Calvert Water, Ice and Electric Light Company.

Athens, Ga.—The telephone service is exceedingly prosperous, and a large number of new 'phones are being now put in.

Jonesboro, Tenn.—The town will be furnished with electric lights by the Watauga Electric Light and Power Company.

Fernandina, Fla.—The plant of the Fernandina Light and Power Company will be improved and its capacity increased.

Huntington, W. Va.—A new dynamo has been recently added to the equipment of the Electric Light and Street Railway Company.

Baltimore, Md.—Negotiations are now in progress to organize an Edison incandescent electric light and power plant to cost $1,000,000.

Macon, Ga.—Philadelphia capital will build a new electrical line out to and along the Houston road, if sufficient local encouragement is held out.

Hope, Ark.—Bids are now open, till Dec. 3, for constructing water-works and an electric light plant. Mayor J. H. Black can give information.

Jacksonville, Fla.—The street railroad company has sought and obtained permission to operate its lines by electricity, using the storage battery system.

Ashland, Ky.—The motive power of the Ashland & Catlettsburg Street Railroad Company's lines will be changed to electricity and their lines extended.

Salisbury, N. C.—The Western Union Telegraph Company has recently established a new line on the Yadkin Railroad, which runs between that point and Norwood.

Baltimore, Md.—The South Baltimore and Curtis Bay Railroad Company's new line will be 3½ miles long, costing $100,000. Contract has been let to Rutherford & Seddon.

Montgomery, Ala.—The proposed electric car line will not materialize rapidly, as the City Council has refused to grant the franchise asked for, by a vote of 4 to 5 against.

Weston, W. Va.—New machinery and increased capacity are the improvements of the electric light, power and water company; the capital stock has also been increased to $15,000.

Galveston, Tex.—The South Galveston & Gulf Shore Railroad Company has been granted right of way, on certain streets, en route to the 13-mile road to South Galveston, and work will commence at once.

The Arlington Electric Road.—Work on the Arlington Electric Railroad is progressing so rapidly that its most sanguine promoters say that it will be completed by the 15th of the coming month.

Athens, Ga.—Last month the Council ordered the rents for electric lights withheld until the lights were better. Last week they were reported as giving satisfaction, and the Council ordered the rents paid.

Lynchburg, Va.—The committee on lights reported in favor of renewing the contract with the Piedmont Electric Illuminating Company for lighting the city for the next three years, and the report was adopted.

Portsmouth, Va.—Reports are to the effect that a number of citizens will assume the obligations and expenses of the electrical road, previously mentioned as desired, to Port Norfolk, as soon as a charter is obtained.

Asheville, N. C.—The construction of the Asheville Thermal Belt Electric Railway will be undertaken at an early date. This road will open up one of the most beautiful and richest sections of mountain country in the South.

Norfolk, Va.—Notwithstanding the refusal of the Western Union Telegraph Company and the Postal Telegraph Company to pay a license tax for the use of the streets of Portsmouth, the City Council has again imposed a tax of $125 each for the current year.

Lynchburg, Va.—One of the city railway company's electric cars, which has been fitted up with Eickemeyer's double-geared machinery, was placed on the track a few days since. It gave abundant satisfaction, climbing the steepest grades with apparent ease.

Richmond, Va.—The petition of the Bell Telephone Company to place underground wires was discussed, and after much wrangling and speechmaking the committee decided to return the paper to the committee proper, with the recommendation that its request be refused.

Clifton Forge, Va.—Electric lights will be turned on for the first time on the 28th inst. The Clifton Forge Electric Light and Power Company has now completed a fine plant. It is supplied with an Eclipse engine of 133 h. p. and with dynamos and other appliances furnished by the Brush Electric Company, of Cleveland, O. The plant has a capacity of fifty arc lights and 750 incandescent lights, of 16 c. p. each, and is so constructed that the capacity can be readily increased. The company is a strong one, with George K. Anderson as president; J. L. Page, treasurer, and J. G. Woodward, secretary. H. A. Taft, of Adams, Mass., an experienced electrician, will superintend the plant.

Rome, Ga.—The sale of the Rome Street Railway to a syndicate of capitalists from Washington, D. C., has been consummated, and the papers have been drawn up and recorded. The entire system is to be changed into an electric line, and bonds amounting to $100,000 have been issued for the purpose of creating funds with which to bear the expense of the contemplated improvements. These bonds bear six per cent. interest, and are floated by the American Security and Trust Company, of Washington, D. C. It is stated that another issue of bonds will be made later, and the power plant and the electric equipment will require fully $100,000. A mortgage on the lines, wires, cars, dynamos, power station, and in fact all of the property of the company, has been given to the American Security and Trust Company, to secure the $100,000 of bonds. The new company is composed of Washington capitalists, with J. S. Laurence as president, and S. H. Black secretary and treasurer. The latter gentleman is president of the Rome Land Company. The engineers are expected to be in Rome during the coming week, when work will commence. The improvement contemplates the establishment of a large electric light plant, which will be one of the most important features about the new enterprise. This plant will comprise both arc and incandescent lights.

V. N. B.

Augusta, Ga., Nov. 27, 1891.

The Augusta Exposition is now in progress, and the electric display is its most distinguishing feature. It is the opinion of prominent electric experts that this display is the most comprehensive and best ever arranged at any exposition in the United States. Those interested in electrical appliances were invited to visit the exposition and examine and carefully investigate this department. Whereas electric displays in previous expositions have been largely confined to electric light exhibits, the display here is an object lesson by which it may be seen to what extent electricity is pushing its way in the mechanical arts and sciences, and is forging to the front as the motive power of this age. The exhibit shows electricity worked pumps, elevators, rock drills, hoists, sewing machines, pianos, fans, ice machines, clocks, and so on to the end of a long list. These are applications of this wonderful agent which are new and which have never been seen in the South before. The following is a list of the companies making the largest displays. In addition to those enumerated there are many exhibits of electrical supplies and appliances of another nature: Thomson-Houston Electric Company, Hoisting and Mining department; the Whittier Machine Company, Electric Elevator; Phœnix Glass Company Glass Fixtures for Electric Appliances; Consolidated Electric Manufacturing Company, Crocker-Wheeler Motor Company, Perkins Electric Switch Company, Electric Construction and Supply Company, Standard Electric Time Company, Universal Arc Light Company, the E. S. Greeley & Co., Ries Electric Specialty Company, Edison-Lalande, Thompson & Robertson, the Hardy Ice Machine, the Hickok Electric Ruling and Paging Machine, the Everett Piano Company of Boston, operated by electricity; the Edison dynamo lighting, George R. Lombard & Co.'s machinery exhibit; the Thomson-Houston plan for lighting the building consisting of six 50-arc light dynamos, giving 300 lights. In the latter exhibit the name of Thomson-Houston is made of 170 incandescent lamps, which hangs as a sign over the mining display of the Thomson-Van Depoele Electric Mining Company. The Thomson-Van Depoele company was prompted to make a complete exhibit of electric mining machines, by reason of the fact that the Southern States have immense mineral interests. The electric mining machinery will be in demand through the mining districts to assist in all the operations of development. This company has spared no expense or labor to make its exhibit an attractive and practical one. The exhibit is in charge of Mr. Francis W. Wilcox, of the Southern office of the Thomson-Houston Electric Company, at Atlanta, Ga., who is assisted by Mr. Chas. Fay, from the exhibit department of the Thomson-Van Depoele Electric Mining Company's factory, at Lynn, Mass. Another interesting feature of the electric exhibit is the electric hoist which hauls a bale of cotton up to the roof by way of demonstrating the methods of work. These hoists are of two kinds, portable and stationary, and vary from 1½ to 15 h. p. of motor, and in lifting capacity from 200 to 7,560 pounds. The outside dimensions of the large hoist are 9 feet by 7 feet 4 inches, and the total height is nearly 6 feet. The motive power is furnished by a Thomson-Houston motor of 35 h. p., wound for a potential of 440 volts. It is series wound and runs normally under load at a speed of 1,100 revolutions per minute. A speed reduction from the motor armature to the drum of 25½, is accomplished by one intermediate shaft with proper gears and pinions. This gives a rope speed of a little over 500 feet per minute, or 0.492 foot per revolution of the motor. The outfit is equipped with five controlling levers. One operates the rheostat contact, one the drum clutch, two are brake levers, which are entirely independent of each other, and the last throws the reversing switch, giving the drum, when thrown into action with the motor, positive motion in either direction of rotation. The controlling levers are all latched and within easy reach of the operator. The gears and pinions are carefully covered to prevent accidents, and the motor has self-oiling bearings. The brake, consisting of a heavy iron band extending almost entirely around the drum circumference, is operated by a foot lever. A glance at the machine in practical operation will suffice to show the spectator the ease with which one person, owing to the convenient arrangement of the various governing devices, can operate it. Another exhibit is an electric percussion rock drill, which is one of the latest and most successful applications of electricity. Another interesting feature of this exhibit is a solenoid coal cutter and a system of underground haulage. The Crocker Wheeler Electric Motor Company has an exhibit of motors and dynamos. Mr. Geo. C. Field represents the company, assisted by Mr. George W. La Rue, general sales agent.

CANADIAN NOTES.

Ottawa, Nov. 27, 1891.

Kentville, N. S.—This town will be lighted by electricity by Christmas.

Winnipeg.—Tenders will shortly be invited for the lighting of the streets, as the present contract expires early next year.

Annapolis, N. S.—Messrs. Farser & O'Dell, under the name of the Annapolis Electric Light Company, are putting in a plant to light the town. The engines are 50 h. p., and the dynamo is an Edison.

Carleton, N. B.—The Carleton electric light station, with Clarke's box mill attached, was entirely consumed by fire on the 19th inst. The loss is about $15,000. The owner of the building was Daniel Clarke.

Springhill, N. S.—The Edison Electric Light Company has succeeded in organizing a local company for the running of its plant, of which Mayor Hall is president and John Murray secretary. The Town Council has given an order for street lighting. The plant is to be in operation before Christmas.

Port Arthur, Ont., will soon be the happy possessor of what are claimed to be the first street cars in Canada to be heated by electricity. Two cars for that place are now in process of construction at the works of Messrs. Patterson & Corbin, St. Catharines, who make a specialty of electric street cars.

Truro, N. S.—The Electrical Light and Power Company of Truro have just put in a new and powerful Robert Armstrong engine. This engine, the work of Messrs. A. Robb & Sons, Amherst, was made under the direct supervision of Mr. Armstrong, steam engine expert from New York, who was engaged especially for this purpose.

Chatham, N. B.—Application has been made to the New Brunswick government by Messrs. MacDougal Snowball, J. B. Snowball, Jas. D. D. B. MacKenzie, W. B. Snowball and Geo. E. Fisher, all of Chatham, for incorporation as the "Chatham Electric Light Company," with a capital of $20,000 in $100 shares. Messrs. James MacKenzie, MacDougal Snowball, Jabez B. Snowball and Francis E. Winslow, all of Chatham, and Scott Fairley, of Blackville, ask for incorporation as the "Miramichi Telephone Company," with a capital of $10,000 in $100 shares.

Ottawa, Ont.—A sensation was caused last week by the news that Senator Clemow, acting for the Ottawa Electric Light Company (arc light), had given notice to the Standard Electric Light Company of a claim for $40,000 damages by the use of certain machinery used by both companies, to which he declares he has exclusive rights. Mr. Clemow claims that his company purchased the exclusive right to use such machinery in the city of Ottawa and vicinity, from the Royal Electric Company, of Montreal. The Standard company denies Mr. Clemow's claims and notifies its customers that it will protect them against all interference in the use of electric light and power appliances by Mr. Clemow's company, and warns Mr. Clemow that his company will be held responsible for any annoyance or loss to which the customers of the Standard company may be subjected through his threatened legal proceedings.

Electric Lighting in Canada.—The Council of an Ontario town recently sent inquiries to nearly all the towns and cities in Canada where the electric light is used for street lighting, as to the yearly cost of each lamp. The replies develop two surprising facts, first, as to the number of places in which electricity is used for street lighting, there being returns from no less than 38 places; and second, the great diversity in prices, which range from $17 per light in Cornwall to $146 in Montreal. The figures are very incomplete, as data is wanting as to the number of lights used, length of lighting hours, and candle power of lamps, but still they are interesting. Here is the list of places and prices: Cornwall, $17; Markham, $36; St. Mary's, $37; Whitby, Newmarket and Palmerston, $45; Lindsay, $48; Simcoe, $50; Kincardine, $52.80; Woodstock, $56.50; Orangeville, $57; Paris, $58.50; Ingersoll, Wingham, Peterboro and Berlin, $60; Cobourg, $62.50; Brampton, $64; Bowmanville, $65.05, Kingston, $65.80; Stratford and Galt, $66; Barrie, $70; Mount Forrest, $75; Ottawa and Yarmouth, $80; Windsor, $80.30; Truro, $85; London, $94.05; Brockville, $101.50; Hamilton, $102.10; St. Thomas, $102.20; Brantford and Belleville, $105; Toronto, $108.59; Montreal, $146.

ENGLISH NOTES.

London, Nov. 11, 1891.

Municipalities and Electric Traction.—The members of the Wigan Steam Tramway Syndicate were shown over the Thomson-Houston line at Leeds last week by Mr. Graff Baker. This syndicate has in contemplation the substitution of electricity for steam and, no doubt, what Mr. Graff Baker had to tell and show them tended to further convince them of the advisability of that course.

Crystal Palace Electrical Exhibition.—A meeting of the Honorary Council of Advice and of the special committee appointed by the Electrical Section of the London Chamber of Commerce is to be held next Wednesday week at the Mansion House under the presidency of the Lord Mayor of London. The meeting will discuss the question of how the exhibition may be best used as a means of advancing electrical science. The whole of the available space at the palace is now allotted, and it is in contemplation to erect extra buildings to provide additional accommodation.

Experiments on the Electric Discharge.—In the *Philosophical Magazine* for October and November, Prof. J. J. Thomson describes at length his interesting experiments on the electric discharge through gases. These investigations were carried on at much the same time as the brilliant ones of Mr. Nikola Tesla, and were briefly alluded to early in the summer by Prof. Thomson on the occasion of the visit of the Physical Society of London to the Cavendish laboratory at Cambridge. Although of an eminently mathematical mind Prof. Thomson's articles are almost entirely devoid of mathematical symbols, and his reasoning throughout is clear to any one of ordinary understanding. Prof. Thomson has satisfied himself by these researches that a vacuum is a perfect insulator, and that a piece of iron submitted to rapidly altering magnetizing forces still behaves like a magnetic substance. No doubt because he is not of such a practical turn of mind Prof. Thomson does not insist on the possible commercial utilization of the phenomena under investigation.

The Discovery of Auto-Excitation.—Mr. C. T. Whitmell, of Cardiff, one of H. M.'s inspectors of schools, has recently published a note with reference to the self-excited dynamo, which is of some historical interest. Twenty-eight years ago in November, 1863, Mr. Whitmell wrote to Faraday propounding the following conundrum: "In an ordinary magneto-electrical machine the power is derived from steel magnets. Would a piece of iron covered with wire do instead of the steel magnet, the iron to form an electromagnet magnetized by the magneto electricity, the iron being first just magnetized by a battery, the future magnetization being kept up by the current that the magnetized iron itself produces?" Mr. Whitmell states that the suggestion of the battery was due to the fact that he did not allow for any residual magnetism, which was indeed not allowed for four years later when a large number of individuals rushed to the Patent Office to patent "Auto-excitation." Faraday replied to Mr. Whitmell's inquiry with an emphatic "no," adding, however, that he was at the time unable to give the question full consideration owing to ill health. A negative reply from a scientist of such eminence naturally settled the matter so far as Mr. Whitmell was concerned, and the result was that the names of Siemens and Wheatstone became connected with the discovery of the principle of "auto-excitation." It is curious to note the complete ignorance on the part of both Faraday and Mr. Whitmell of the prior suggestions of Jacob Brett and Hjorth.

London, Nov. 18, 1891.

Brighton.—To-morrow the Brighton Town Council will be recommended by its electric light committee to purchase the undertaking of the Electric Light company for the sum of £7,000 on the condition that the company undertakes to cease competition with the municipal concern.

A Pioneer of Submarine Telegraphy.—At the last meeting of the Institution of Electrical Engineers a portrait of Mr. J. Brett was presented to the institution by a lady artist, Miss Bolton. In seconding a vote of thanks for this portrait, Mr. Latimer Clark gave an extremely interesting account of the connection of this pioneer of telegraphy with the history of the industry. Mr. Brett's name was practically unknown to large portion of the audience, who were astonished to hear that one who obtained the concession for the laying of the first submarine cable between England and France, and who was one of the two who headed the subscription to the first Atlantic cable, taking equal shares with Cyrus Field, and who was largely instrumental in developing submarine telegraphy generally, should be not only comparatively overlooked in the distribution of honors, but at present depending on an annuity of £100 a year and on the kindness of his friends.

Electric Traction in England.—Although we can only boast at the present moment of having 29 miles of electric lines in operation in this country, constructed on no less than four different systems, the opposition to electric haulage seems at last to be breaking down. The heavy electric lines at present in progress are the Central London Railway (six miles) and the Liverpool Overhead Railway (six and a half miles), while permission has been granted for the overhead trolley system on the Staffordshire lines, which comprise some 23 miles of track, and as I mentioned in a recent cablegram, the Glasgow Municipality has by fifty votes to six decided to take over the tramway system of that city in 1894 and there is but little doubt that electricity will then be adopted. The two-mile open-conduit line at Blackpool continues, however, to be the best evidence that we have here that electric traction can be made to pay. It has recently announced a dividend of 7½ per cent. on its paid up capital of £20,000 and adds a substantial sum to its reserve fund. The twelve cars which are in operation have run 98,000 car miles and carried 934,000 passengers during the past twelve months, increases respectively of 6 and 15 per cent. The figures put down for conduit and for motor and gear repair may be of interest on your side of the water. The conduit repairs for one year amounted to £144, or £72 per mile; the motor and gear repairs came to £192, or £16 per car, which is about 5 per cent. of their original total at cost, and about 13½ per cent. of the original cost of the complete electrical apparatus.

Annual Dinner of the Institution of Electrical Engineers.—The third annual dinner of the Institution of Electrical Engineers was held on Friday last, and there was a good attendance of members. The President, Prof. Crookes, in his address laid great stress upon the almost infinite possibilities of electricity. We had, he said, abandoned the preposterous notion that pure research was mere waste of time. As an instance of these future possibilities Prof. Crookes alluded at some length to the researches of Herts,

Lodge and Nikola Tesla, which seemed to him to lend probability to telegraphy without wires and electric light without leads. In any case he was of opinion that by Mr. Nikola Tesla's work our knowledge of the possibilities of static electricity had been considerably extended. He next referred to the enormous energy locked up in the ether and to the likelihood of its ever being made available. Electrical engineers had abundantly justified their existence, but instead of smooth prophecies it would perhaps be better to take a bird's-eye view of the solid work that lay ahead. The president then enumerated the many promising fields of research still unexplored. What did we know, he said, of the action of electricity on life, whether vegetable or animal? Did not the tedious conversion of chemical energy into heat, heat into mechanical power, and that into electricity, seem a very roundabout process, with losses at every step? Nature supplied energy in every direction. How much of this prodigious quantity could we make available? These were problems which might safely be left to the ingenuity and inspirations of electrical engineers. What was really in store in the way of future wonders was folded "in shady leaves of destiny." Sufficient for the day were wonders thereof. Sir George G. Stokes (ex-president of the Royal Society) said that the great characteristic of electrical science was its multitudinous points of contact with all other sciences, many apparently remote, and the remarkable manner in which philosophical investigations had found their immediate practical applications. Some 40 years ago he was sitting at dinner beside Faraday and remarked to him that a great step would be made if we could say as much of electricity as we said of light when we considered it as consisting of vibrations. Faraday's reply was, "We are yet a long way off from that." Nevertheless, within this short period the connection between light and electricity had been rendered much more clear by the remarkable investigations of Clerk Maxwell and the recent discoveries of Hertz. Sir John Pender, in replying to the toast, "Electricity in its Practical Applications," alluded to his life long connection with submarine telegraphy and stated as an example of the saving effected by practical improvements that the application of Dr. Muirhead's duplex system to cables meant a capital saving of twenty millions sterling, since that amount would have to be spent to enable the existing traffic to be taken, were the cables not duplexed. With regard to his connection with the electric lighting of the metropolis, he remarked that at present only 300,000 lights were connected to electric supply mains. He should not consider that electricity had done its duty until there were 3,000,000 connected.

News of the Week.

THE TELEGRAPH.

The Use of Old Rails in India.—The Great Indian Peninsular Railway is now, according to *Indian Engineering*, utilizing old rails as telegraph posts, which are very effective, being both cheap and durable. An extra piece of rail is bolted to the long rail at its lower extremity, in order to counteract the top weight. This piece is generally from four feet to six feet long for an ordinary telegraph post. Sometimes two pieces are necessary for specially long poles. This end is then buried in the soil, the ground is well rammed at the base, and the pole is at once ready for its fixings. The brackets for these rail posts are of wrought angle iron, a piece of about two feet long being bolted to the post, and the ends being bent somewhat to contain the insulator pins. This presents a very neat appearance, and keeps the wires well apart, so that they do not come in contact during high winds.

THE ELECTRIC LIGHT.

Wichita, Kan.—Electric headlights have been placed in the trolley system street cars and are a success.

Scranton, Pa.—The Scranton Edison Company has recently sold a 3,000-light Edison plant to the Sanquoit silk mills, of Scranton, and a 1,000-light Edison plant to the Scranton Lace Curtain Manufacturing Company. The company also has in contemplation the installation of another 3,000-light plant complete with engines, boilers, dynamos, etc. The system to be used has not been decided yet.

The New York Safety Steam Power Company has been awarded the contract for furnishing the Bullett Building, Philadelphia, with three 13 x 12 horizontal automatic engines for dynamo service. The foundations for the engines are now being constructed, and it is expected the plant will be in operation early in December. The Bullett Building is centrally located, and it is intended to make this the finest and most complete electric light plant in Philadelphia.

The Easton Electric Company has recently completed the installation of a fine incandescent plant in the machine shops of Mr. M. T. Davidson, located on Keap street, near Kent avenue, Brooklyn, N. Y. The plant consists of the company's No. 6, 250-light, incandescent dynamo, 130 incandescent lamps of different candle-power, and seven Easton "X" arc lamps, burning on the same circuit. The shops are brilliantly illuminated, and Mr. Davidson is now wondering how he ever managed to conduct his extensive business without the light.

A Use for Old Incandescent Lamps.—In the *Bulletin de l'Association Belge de Photographie* for July, Prof. F. Leconte has a brief note describing some experiments made by him for the purpose of testing the suitability of the incandescent lamp as an indicator of vibrations. A Khotinsky lamp with a looped filament was placed on one of the supports of the Physical Laboratories of the Ghent Institut des Sciences, and a telescope was fixed on another of the supports, the lamp being lit up from behind. Blows on the floor, which did not affect the mercury troughs usually employed for the purpose in the slightest degree, threw the filament into a state of vibration lasting several seconds. Prof. Leconte points out that a long looped ruptured filament is the best, and that the vacuum must be good and the bulb unblackened.

THE ELECTRIC RAILWAY.

Brooklyn Roads Want the Trolley System.—The Railroad Committee of the Brooklyn Board of Aldermen has been giving a hearing on the application of the presidents of the various surface roads in that city for permission to substitute the electric trolley system for horse power on all their routes. All the railroad companies, with the exception of the Broadway road, united in a joint application to the aldermen as well as to the State Railroad Commissioners. It is said that most of the companies have already obtained the consent of a majority of the abutting property holders. The companies promise to have the new system in operation before next winter if a speedy decision in their favor is reached.

LEGAL NOTE.

Taxation of Electric Lighting Companies.—Where an electric lighting corporation was incorporated in New York in 1880, under chapter 37 of the laws of 1848, relative to the formation of gas light companies, which were by a later act authorized to use electricity instead of gas, but the corporation in question never produced anything but electricity, the New York Supreme Court, General Term, held (People ex rel. Edison Electric Illuminating Company vs. Wemple) that the company was not a manufacturing corporation, and as such exempt from taxation upon its franchise. The court said: "Whether such a company is a manufacturing company seems to depend upon the question whether electricity is manufactured by the relator, or whether it is already in existence, and is simply collected or gathered by the relator and utilized. The processes adopted by the relator are stated in the case, and we have the differing opinions of learned experts laid before us. As a scientific question it would seem to be still in the debatable stage. Something also seems to depend upon the definition of terms. . . . Following our impressions, however crudely formed they may be, we conclude that electricity exists in a state of nature, and that the relator collects or gathers it, and does not manufacture it. We refrain from any exposition of the premises upon which this conclusion is based. If this conclusion is true, the relator is not a manufacturing corporation, and therefore not within the exemption of the statute."

EDUCATIONAL NOTES.

Electrical Engineering at Tulane University, New Orleans.—This department of Tulane University has lately received considerable addition to its equipments. Among the more important may be mentioned a 300-light Slattery alternator, with complete outfit of instruments and converters; a 15-light Wood arc dynamo, with accessories; a 6-light Thomson-Houston arc dynamo, with arc and series incandescent lamps; and four Edison motors of different forms and sizes. An Edison arc system has been ordered, and some parts have been received. In all there will be added this Fall 12 dynamo machines, 14 arc lamps and a variety of instruments, motors and accessories. The course is increasing in popularity, and there is this year a decided increase in the number of students taking it.

Brooklyn Institute.—The December bulletin of this educational institution contains the following announcements for this month: A lecture on Dec. 4 by Mr. Wm. S. Barstow, general superintendent of the Edison Illuminating Company, of Brooklyn, on "The Direct Application of the Armature of a Motor to the Running of Machinery," illustrated by dynamos and appliances; a lecture on Dec. 23 on "Static Motors," illustrated by motors and demonstrations; a lecture on Dec. 18 by Mr. J. Stanford Brown on "Electrical Units in Theory and in Practice," illustrated by experiments and antern diagrams. The third meeting of the electrical department of this institute was held on Nov. 20, at which Mr. Edward H. Lyon gave a lecture on "Electrical Measurements of Low Resistance." The institute having received an invitation to participate in the World's Fair, the following gentlemen were appointed to represent the electrical department of the institute: J. Snford Btarown, consulting engineer, New York; William D. Sargent, superintendent Metropolitan Telegraph & Telephone Company; W. S. Barstow, electrician Brooklyn Edison Electric Light Company; Edward Peck, electrician, Brooklyn Municipal Electric Light Company; F. V. Henshaw, electrician C. & C. Motor Company.

PERSONALS.

H. W. Hamlin, formerly manager of the Pawtucket Railroad central station, and later with the Consolidated Company, of Portland, Me., is now with H. Ward Leonard & Co., of this city.

Mr. Robert S. Dobbie, of the Edison General Electric Company, who recently designed the projector in use on the Madison Square Garden Tower, had a royal Thanksgiving. In addition to his turkey dinner, he was presented with a son.

Mr. F. W. J. Hubel, of M. Immisch & Co., of London, the manufacturers of the well known Immisch motor and launches, is in this country. Mr. Hubel while here will probably endeavor to dispose of the American patents of Mr. Immisch. Mr. Immisch himself is expected here shortly.

Mr. Edward Lafloe, formerly electrical engineer for the Saranac Worsted Mills, of Providence, R. I., and lately with the North Attleboro Steam and Electrical Company, and Attleboro, North Attleboro and Wrentham Electric Street Railway Company, has been re-engaged to assume charge as electrical engineer of the Providence Worsted Mills and Saranac Worsted Mills.

MISCELLANEOUS NOTES.

Electrical Section of the Franklin Institute.—The programme for the stated meeting of Tuesday, Dec. 1, announced the following communications to be presented: The Electric Railway of Buda-Pesth, by Mr. H. W. Bartol; Lauffen-Frankfort Alternating Current Tranmissions, by Mr. Carl Hering; Notes on Electro-magnetic Machinery, by Mr. W. S. Aldrich, of Johns Hopkins University, Baltimore, Md. Annual reports of officers and standing committees were also announced, as well as the election of officers for the year 1892.

The Action of Acids on Aluminium.—"One of the most cherished beliefs concerning this over-rated and under-rated metal," says *Industries*, "has been that it is not appreciably attacked by nitric and sulphuric acid, and on the strength of this belief its use has been suggested for purposes as diverse as the replacement of platinum in the Grove battery and of cast iron in a nitric acid still. The hopefulness of these suggestions has now been largely discounted by some experiments of M. Leroy, who has shown that aluminium is appreciably soluble in nitric and sulphuric acid of various strengths and different temperatures. Nor can this action be ascribed to the presence of hydrochloric acid as an impurity in the commercial acids, as was recently suggested by Mr. Hunt, of the Pittsburg Reduction Company, seeing that the effect of the pure acids does not differ sensibly from that of commercial specimens."

Industrial and Trade Notes.

Col. J. H. Shay, of the Charles Munson Belting Company, Chicago, has secured the order for three 60-inch belts for the Louisville plant.

Messrs. Clower, Harris & Co., of Dallas, Tex., have filed with the clerk of Dallas County a trust deed conveying their entire stock of electrical supplies, fixtures, book accounts, and other assets belonging to the firm.

Dynamo Oils.—Geo. P. Jones & Co., of 708 North Main street, St. Louis, Mo., are supplying electric light and power stations with a high grade dynamo oil that is indorsed by all users for its smoothness and economy.

Sheet Zinc.—Specialty manufacturers who require rolled sheet zinc cut to special size for base plates and other parts of apparatus can secure zinc plate of the highest quality from the Illinois Zinc Company, Peru, Ill., which also makes a specialty of battery zincs.

Messrs. Chas. A. Schieren & Co. have just shipped the Franklin Electric Company, Franklin, Venango County, Pa., a 20-inch perforated electric double ply leather belt. Other belts were shipped last spring when the station was put up, and they were liked so much that a main belt was ordered from the same company.

Messrs. Truex & Vail, of 136 Liberty street, New York, report that their business in ammeters is on the increase, that they are selling a great many, and receive many letters testifying as to the accuracy of their ammeters. The swinging ball lightning arrester still holds its own, and is becoming popular on account of its efficiency.

The Thomson-Houston shareholders of preferred stock have increased in number about 200 in the past four months. It is said that the company paid out during the first nine months of the year $860,000 in dividends, that its bills receivable were increased by more than $300,000 and that the debt has decreased by more than $300,000.

A Million Feet.—After an exciting competition, in which the Chicago supply houses were deeply interested, George Cutter, with his simplex rubber wire, captured the Chicago Edison Company's order for one million feet of number fourteen. This is the largest order placed in Chicago this year and shows the growing popularity of this wire.

Destroyed by Fire.—The Thomson-Houston Carbon Company's works at Cleveland, O., was partially destroyed by fire on Nov. 24. The company's stockroom, however, is reported safe with many millions of carbons on hand. The company sends us word that it will be able to supply all its customers promptly and that it will rebuild that part of the works destroyed.

The Williams Engine Company, of Baltimore, Md., has received subscriptions to all of its stock, and is now about to select a place for the shops. It is expected that the work will begin as soon as tools can be put in place. Orders are already on hand for quite a number of engines, and the outlook is very promising. The company will build engines of all capacities up to 250 h. p., both simple and compound.

Engine for the World's Fair.—The Bureau of Construction of the World's Columbian Exposition has contracted for a 400-h. p. Armington & Sims engine for use in connection with their temporary light and power plant. The engine was shipped immediately, and is probably in operation by this time. The matter is in the hands of the Pond Engineering Company, general western agent for the Armington & Sims engine.

The Chandler & Taylor Company, of Indianapolis, Ind., has issued an illustrated catalogue of its engines and boilers. The illustrations shown give very clear ideas of the construction of the apparatus, and tables are given showing in detail the dimensions and other data of all the apparatus. In compiling the catalogue it has been the intention of the company to present in detail the various points of superiority of its engines and boilers, and also the advantages peculiar to the various combinations, so that the prospective buyer may ascertain just what he needs.

The Wadhams Oil and Grease Company, Milwaukee, Wis., is manufacturing a graphite grease for use on curves, switch plates, gearing, etc., of electric and street railways. The following letter from a prominent engineer of the Edison Company speaks for itself: "Your graphite curve grease gives perfect satisfaction. Our cars seem to round the curves easier and with less friction and wear than when using other greases. The graphite is pounded into the steel, and gives a smooth surface. For use on switch plates, curves, gearing, etc., of electric railways I heartily recommend it."

A Canadian Agent Appointed.—The Thomson-Houston International Electric Company has appointed the Toronto Construction and Electrical Supply Company, Ltd., of Toronto, Ontario, the exclusive selling agent of its apparatus for the Dominion of Canada. The Toronto company has its main office and show rooms at 63 and 69 Front street, Toronto. Mr. Fred Nichols, the general manager of the Toronto company, is well known in the United States, being a member of the Executive Committee of the National Electric Light Association, and has in the past been quite an extensive purchaser of American electrical manufactures.

The Accumulator Company, of 44 Broadway, New York, has recently issued a pamphlet of testimonials regarding the usefulness and economy of accumulators in connection with electric lighting plants. The following letter written by Mr. T. H. Wickes, the general superintendent of the Pullman Palace Car Company, speaks for itself: "I am pleased to state that the batteries furnished by The Electrical Accumulator Company, of New York, about a year ago, for lighting our cars on the New York & Chicago limited express trains, as also those furnished a few months ago for the Florida special trains, have given excellent satisfaction."

An Increasing Business.—The constant growth of the business of the Electric Merchandise Company, Chicago, has again compelled it to increase its store and office facilities. A lease has been taken of the upper part of the building now occupied by the company, and the second floor is being fitted up for its offices. The much needed room will thus be added for all departments. The only company dealing in electric railway supplies exclusively is to be congratulated on the firm hold which it has on the trade, due to the conscientious manner in which all matters of business are attended to, and also to the fact of its being thoroughly equipped for the particular line of business in which it is engaged.

The Underwood Manufacturing Company, of Chicago, Ill., received at its store, 33 South Canal street, a few days ago, 200 feet of 62-inch belt for the Chicago City Railway Company. This is one of two belts the same length and width which will be put in the railway power house at Twentieth and State streets as soon as the engines are in position. The company also received a few days ago an order from the Fraser & Chalmers Company for about 75 feet of 42-inch and 150 feet of 12-inch belt to be placed in the electric light plant in the Masonic Temple. There will also be placed in position on large engines in the Washburn & Moen Company, at Waukegan, Ill., two 40-inch belts, one 36-inch and several 24-inch; all of them of this company's cotton and leather heavy double belts.

The Electric Appliance Company reports having secured the general western agency for the swinging ball lightning arrester and the Walker ammeter. The swinging ball lightning arrester has successfully stood the test of the past two years. The manufacturers have yet to record a single instance where it failed to do its work. The swinging ball lightning arrester has no fuse, and requires little or no attention. It is entirely protected from moisture, and has no electromagnets or intricate parts to adjust. Each arrester is provided with a terminal wire to be joined to the line and a binding post for the ground connection. They are adapted for either arc, incandescent or street railway circuits. The Walker ammeter fills the demand for a reliable instrument at a moderate cost.

Wm. Cramp & Sons' Ship and Engine Company, of Philadelphia, is making extensive changes in its plant and has placed

the contract for a new boiler shop with the Berlin Iron Bridge Company, of East Berlin, Conn. This boiler shop will be constructed entirely of iron and will be composed of two parts, one part 55 feet in width by 350 feet in length made very high between joints on account of moving large marine boilers over each other. This portion of the building is controlled by a 50-ton traveling crane, which is to be furnished by Wm. Sellers & Co., of Philadelphia. Connected with this main portion will be a wing 58 feet wide by 370 feet long, served the whole length by a 20-ton Sellers traveling crane. The building is composed entirely of iron from the designs of the Berlin company, and will be one of the most complete of its kind, as no pains or expense has been spared to make it complete in every detail.

Success of H. Ward Leonard & Co.—Large manufacturing companies are quick to appreciate the advantages of having in their employ experienced electrical engineers to advise them as to applications of electricity in their business. This is evidenced by the success in this line which H. Ward Leonard & Co. are obtaining. Among the concerns of importance which have recently retained them as consulting electrical engineers are Wm. Sellers & Co., the well known machine tool builders, of Philadelphia; Otis Brothers & Co., of elevator fame, and the Ingersoll-Sergeant Drill Company. No large manufacturing concern whose product involves the use of power can afford to neglect the rapid progress of electrical motor applications. H. Ward Leonard & Co. charge a definite sum per year for their services as consulting engineers, and the manufacturing concerns seem to like this feature of definiteness rather than a percentage or a retainer and individual charge for individual service.

The Page Belting Company, of Concord, N. H., reports a very active business for October, with sales very largely in excess of one year ago. Among the companies furnished are the following: Edison Electric Illuminating Company, Easton, Pa.; People's Street Railway Company; Scranton, Pa., and Huntington Electric Light Company, Huntington, Pa. A large drive belt to Jas. Leffel & Co., Springfield, O. The Watertown Arsenal in Massachusetts, a complete outfit including several 20 and 26-inch belts. In its dynamo belting, both plain and Eureka, the company reports a very large business. Among the parties furnished with these belts are the following: United Electric Railway, Nashville, Tenn.; Thomson-Houston International Electric Company, New York; Binghamton Electric Company, Binghamton, N. Y.; Electron Manufacturing Company, Brooklyn; Salem Electric Company, Salem, Va.; St. John College, Fordham, N. Y.; Myrtle, Lead, Zinc and Mining Company, Austinville, Va.; Home Electric Light and Heating Company, Tyrone, Pa.

Business Notices.

Battery Cut-Out, Cheap.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren Street, Syracuse, N. Y.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

U. S. PATENTS ISSUED NOV. 24, 1891.

463,615. Electric Controller for Elevators; William Baxter, Jr., of Baltimore, Md., Assignor to the Baxter Electric Motor Company, of Maryland. Application filed Jan. 29, 1891. The combination, with a suspended car moving in a hoistway, of a rotating motor shaft, a hoisting pulley and rope for elevating the car, means for coupling the motor shaft with the hoisting pulley, an electromagnetic shifter for operating such coupling device, an electric circuit connected with the coils of the electromagnetic shifter, and one or more switches provided with suitable contacts connected with said circuit and adapted when the switches are operated to vary the course of the current in the coils of the electromagnetic shifter.

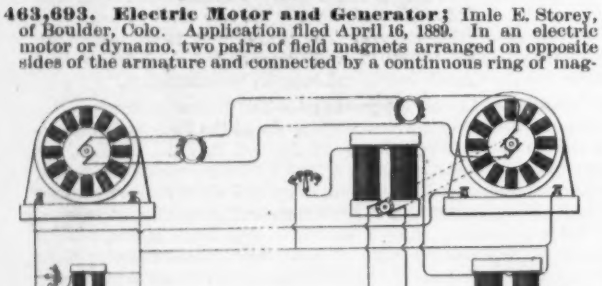
463,635. Brush Holder for Electric Motors; James E. Lyons, of Cleveland, O. Application filed March 19, 1891. In a brush holder for electric motors and the like, brush holding standards, angular guideways for brushes in said standards, and a base to support the same, said base being so constructed as to admit of its own adjustment or that of the brush holding standards at substantially right angles to the axial line of the motor armature and to move said standards toward or from each other.

463,639. Electric Motor Mechanism; Samuel E. Mower, of New Haven, Conn., Assignor to Henry G. Thompson & Sons, of same place. Application filed June 16, 1891. The combination, with an axle, of an electric motor independent of the axle, its armature shaft having a sleeve loosely mounted on it and provided with a gear in mesh with a gear on the axle, and a speed reducing mechanism connecting the sleeve to the armature shaft, comprising a gear on the sleeve, a gear on the shaft, a disc or drum located between said gears and mounted loosely on the shaft, and gears and pinions borne by said disc, adapted to respectively engage the gear on the shaft and gear on the sleeve.

463,671. Armature Core for Dynamo Electric Machines; Elihu Thomson, of Lynn, Mass., Assignor to the Thomson-Houston Electric Company of Connecticut. Application filed Aug. 5, 1889. An iron core for electrical apparatus, built up from plates of sheet iron having a thin adherent scale or coating of hard insulating substance formed naturally in the process of manufacturing sheet iron, and thin interposed distinct separating plates of zinc, tin or other non-magnetic metal, all secured together as a solid structure by any suitable means.

463,691. Railway Signal; Edwin Junius Samuels and Frank Edwin Behrendt, of Janesville, Wis. Application filed May 14, 1891. In a railway signal apparatus, the combination, with an electromagnet and pivoted armature bar, or a revolving signal standard provided with a stud wheel, spring-actuated gear mechanism revolving said standard, an angular lever pivotally connected with the armature bar, and a vertical rock shaft provided with a trip lever and reciprocating bar.

463,693. Electric Motor and Generator; Imle E. Storey, of Boulder, Colo. Application filed April 16, 1889. In an electric motor or dynamo, two pairs of field magnets arranged on opposite sides of the armature and connected by a continuous ring of mag-



No. 463,802.—Electrical Transmission of Power.

netic metal, each pair having a common pole piece, the individuals of each pair being wound in series, but with a different number of turns. (See illustration.)

463,694. Commutator for Electrical Machines; Willis W. Vail, of Quakertown, N. J. Application filed June 23, 1890. The combination, with a rotative cylinder provided with longitudinal bars, short bars, and insulating material between said bars, of a tubular seat on the shaft of the cylinder, collars, insulated rings, connected by screws with said bars, a cylinder and four brushes, two being placed at each side of said rotative cylinder.

463,704. Electric Motor and Dynamo; Albert L. Parcelle, of Boston, Mass. Application filed April 2, 1891. This invention consists of an iron yoke having connected therewith field poles formed of laminæ, each of which is provided with projections that serve to form an enlarged area of contact between the pole piece and the iron yoke, so as to reduce the magnetic resistance to a minimum. The laminæ are secured together by a bar or nut passing transversely through them. The invention also consists in attaching the armature to the hub or spider by iron coupling bars which occupy seats on sockets formed in he armature ring and radial arms.

463,711. Electric Meter; Anthony Reckenzaun, of London, England, Assignor of one-half to James A. Prentz, of Philadelphia, Pa. Application filed Nov. 1, 1890. An apparatus for measuring electric currents or the product of time and currents, comprising indicating mechanism, electromagnets, means intermediate of said magnets and indicating mechanism and acting by gravity to move said indicating mechanism, and a member periodically making circuit with said magnets in alternation for energizing them to lift said gravitating means.

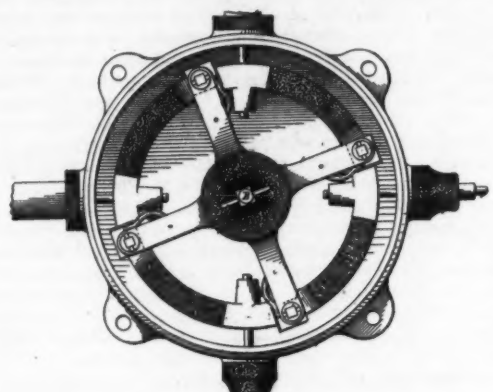
463,715. Conductor and Guide for Electric-Railway Trolleys; Joseph I. Conklin, of Brooklyn, N. Y. Application filed Feb. 10, 1891. An insulated trolley charger and guide for electric railways, consisting of an inverted trough of metal, the sides of which diverge from the base thereof.

463,720. Electric Arc Lamp; William Stafford Hays, of Troy, O. Application filed July 27, 1891. In an electric arc lamp, the combination of a carbon holder, a friction ring clutch, surrounding the same and having oppositely located arms, main and shunt magnets, whose axes are parallel to and substantially equally distant from that of the holder, tubular axial extensions, of non-magnetic material, projecting from said magnets and forming extensions to the tubes upon which the magnet coils are wound and within which are located the magnet cores, cylindrical armatures loosely and axially located in said tubes and having slotted extensions, which are pivoted to the said arms, respectively, and an insulating tube surrounding the holder and supporting the ring.

463,748. Carbon Brush Clamp for Dynamos; Sherburne Morse, of Arkansas City, Kan. Application filed July 25, 1891. A carbon brush for dynamos, comprising a flexible bar or plate, the rear part thereof adapted to be secured in an ordinary holder, the forward part of said flexible bar or plate being provided with a clamping plate and tightening screw adapted in combination with the forward end of the flexible plate to clamp the carbon brush.

463,754. Electric Cigar-Lighter; George Nicholas Engert, of Springfield, O. Application filed Dec. 24, 1890. In a cigar-lighter a lighting or high-resistance conductor supported in an exposed position in a suitable frame, flexible electrical conductors connected to said frame to permit it to be turned to different positions, and an automatic switch within said frame or casing adapted to bring the lighting or high-resistance conductor into circuit with said flexible conductors by the act of bringing said casing to an unusual position.

463,756. Wire-Hanger; Charles A. Jacobs, of Hallowell, Me. Application filed Feb. 14, 1891. A wire-hanger consisting of a frame formed of a base with a face adapted to fit against the side of a part to which it is to be secured, and parallel arms, the rollers formed with concave adjacent faces journaled with suitable bearings in said parallel arms, and a strap passing around the part to which the hanger is secured with its ends extending through perforations in ears formed on the sides of the base of said frame, nuts being provided on said ends for securing said parts together.



No. 463,808.—Electric Subway Switch.

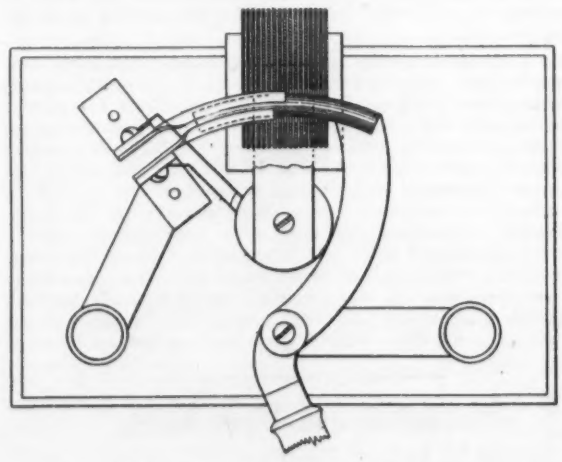
463,760. Electric Conductors for Railways; Charles E. Sargent, of Chicago, Ill. Application filed July 10, 1891. An insulated conductor for electric railways, made up of a wire substantially U-shaped in cross section and a permanently attached layer of insulating material covering the external surface of the wire throughout its entire length.

463,761. Section-Insulator and Lightning Arrester for Electric Railroads; Elihu Thomson, of Swampscott, Mass. Application filed Sept. 1, 1890. A section-insulator for insulating adjacent sections of an electric-railway line conductor, comprising separate conducting plates secured in place, but spaced apart and insulated at points somewhat above their contact-surfaces and having such contact-surfaces separated entirely from one another by an air-insulation space, but rounded and arranged in line to form a continuation of the path of travel of the contact device.

463,762. Electric Arc Interrupter; Elihu Thomson, of Swampscott, Mass. Application filed Dec. 15, 1890. The combination with an electric circuit breaker, of a bundle of insulated conducting plates surrounding one or both of the contacts and an arc distorter acting to divert any arc formed at the contacts to the plates. (See illustration.)

463,763. Lamp Socket; Ferdinand Voigt, of Bockenheim, near Frankfort on-the-Main, Germany. Application filed Nov. 18, 1890. In electric screw-thread contacts, the combination, with one of the elements of the contact having a serrated or toothed thread, of the co-operating element provided with a slot and an elastic or yielding locking dog projecting through said slot and engaging the said serrated thread, said dog operating to lock the elements against accidental rotation in either direction, but yielding and relieving said elements when either of them is forcibly revolved.

463,764. Multiple Fuse Cut-Out; George K. Wheeler, of Chicago, Ill., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed Nov. 26, 1890. A multiple-fuse cut-out comprising a pivoted rotary disc of insulating material, contacts arranged around the edge of the disc on one of the flat faces



No. 463,762.—Electric Arc Interrupter.

thereof, fuses attached to said contacts, and a pair of circuit-terminals making connection with the contacts in pairs as the disc is rotated.

463,765. Trolley for Electric Railways; George H. Alton, of Lynn, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed Feb. 16, 1891. The combination, with a trolley having two contacts, of a suspended conductor having a lower portion engaging with one of such contacts, and a higher portion out of reach of said contact when the latter is in normal operative position, but engaged by the other contact.

463,766. Switch for Electric Railways; Francis O. Blackwell, of Boston, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed Jan. 26, 1891. The combination, with main and branch conductors, of an electric railway, of a folding switch or gate pivoted so as to fold down flatwise in the path of travel of the trolley, thereby allowing the trolley to pass over it.

463,770. Electric Cut-Out; Edwin Wilbur Rice, Jr., of Lynn, Mass., Assignor to the Thomson-Houston Electric Company, of Connecticut. Application filed Dec. 2, 1890. The combination in an electric cut-out, of a base provided with contacts for the line-wires flush with its inner surface, with a perforated cap having contact-arms secured thereto, fuses connected to the contact-arms and extended over unperforated sections of the cap, and screw-studs projecting from the base contacts, with which the contact-arms engage, and located at points substantially in line with the openings in the cap.

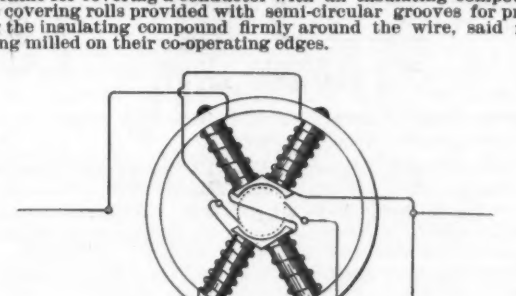
463,785. Electrical Surgical Instrument; Frank L. Connable and Thomas V. Harper, of Xenia, O., said Harper Assignor and said Connable Assignor of one-twelfth to Augusta Mason Connable and Fanny M. Connable, both of same place. Application filed Jan. 15, 1891. An electrical surgical instrument having electrical insulated jaws adapted to connect with battery wires and provided with approximately closed jaws, and an adjustable sleeve adapted to actuate or spread said jaws.

463,802. Electrical Transmission of Power; Harry Ward Leonard, of New York. Application filed Aug. 14, 1891. The method of operating and regulating an electric motor, consisting in maintaining the strength of its field magnet and the position of its commutator brushes constant and altering its speed by varying the electromotive force supplied to its armature. (See illustration.)

463,808. Electric Subway Switch; Louis Albert Fehr, of New York. Application filed Nov. 28, 1890. The invention consists of a switch having ratchet teeth which are alternately conducting and non-conducting, and arranged beneath the line of travel of two moving contact pieces. The said contact pieces are connected to one another and are spring pressed upon the ratchet teeth. (See illustration.)

463,809. Machine for Covering Conductors; Christopher Klotzbach, of Passaic, N. J. Application filed Aug. 1, 1891. In a machine for covering a conductor with an insulating compound, the combination, with rolls for pressing the compound around the conductor, of an endless belt by which the compound may be conveyed to the rolls.

463,810. Machine for Covering Conductors; Christopher Klotzbach, of Passaic, N. J. Application filed Aug. 1, 1891. In a machine for covering a conductor with an insulating compound, the covering rolls provided with semi-circular grooves for pressing the insulating compound firmly around the wire, said rolls being milled on their co-operating edges.



No. 463,693.—Electric Motor and Generator.

463,824. Trolley Wire Hanger; Edward T. Birdsal, of New York, and Lemuel Wm. Serrell, of Plainfield, N. J. Application filed Dec. 1, 1890. The invention consists of a hanger for the electric conductor, formed of one casting and having ends that are channeled on their under edges, a central lip channeled upon its upper surface, and an intermediate opening or slot for allowing the conductor to be passed above the lip and below the channeled ends, the under surface of the lip and the under surface of the conductor being in line, or nearly so.

463,852. Synchronous Telegraph; Charles S. Bradley, of Yonkers, N. Y. Application filed Jan. 28, 1887. In a telegraphic system, the combination of two alternating current machines located at different points, mutually reacting to maintain continuous synchronous movement, an electric connection between them, and telegraphic transmitters and receivers located at such points, the connecting circuit of which passes through synchronously driven mechanism controlled by said alternating machines.

463,867. Automatic Safety Cut-Out for Electrical Conductors; Robert A. Morgan, Jr., of Boston, and Geo. C. Bosson, Jr., of Lawrence, Mass. Application filed Nov. 28, 1890. In combination with the main-line conductors for carrying electric current, a supplemental system of electrical conductors, adjacent and parallel thereto, an electrical resistance between the main and supplemental lines, a mechanical circuit breaker in the main line, and an electro-magnet in the supplemental system placed in proximity to the said circuit breaker whereby the release of the armature of the magnet will cause the circuit-breaker to operate.

463,879. Separator for the Plates of Secondary Batteries; Chas. F. Waldron, of Boston, Mass., Assignor of one-half to Chas. J. Pillsbury and Walter J. Litchfield, of same place. Application filed Jan. 12. The separators are in the form of wooden pockets or folds, each one of which encloses one of the plates of each pair, so as to keep it from contact with the opposite plate and to support the active material thereon.

463,945. Therapeutic Electric Battery; John A. Crisp, of Jefferson, O. Application filed March 31, 1891. An electric battery comprising a series of cells, each consisting of a copper plate doubled upon itself and having its ends brought together, apertured and extended outward to form an ear, with which one of the conductors is to be connected, an absorbent material surrounding the copper plate, and a zinc plate surrounding the absorbent material, the several cells being connected together by a copper plate and the zinc plate of one of the cells provided with a socket, with which the other conductor is to be connected.

463,955. Electric-Wire Insulator; Hiram F. Newell, of Manchester, Va. Application filed Feb. 28, 1891. An insulator consisting of the body having the socket in its upper side and an annular groove around its upper portion, separated grooved arms rigid with the body and extending upwardly beside the upper portion of the body and intermediate downwardly projecting arms.

Copies of the specifications and drawings complete of any patent mentioned in this record—or of any other patent issued since 1886—can be had for 25 cents. Give date and number of patent desired and address The W. J. Johnston Co., Ltd., Times Building, N. Y.